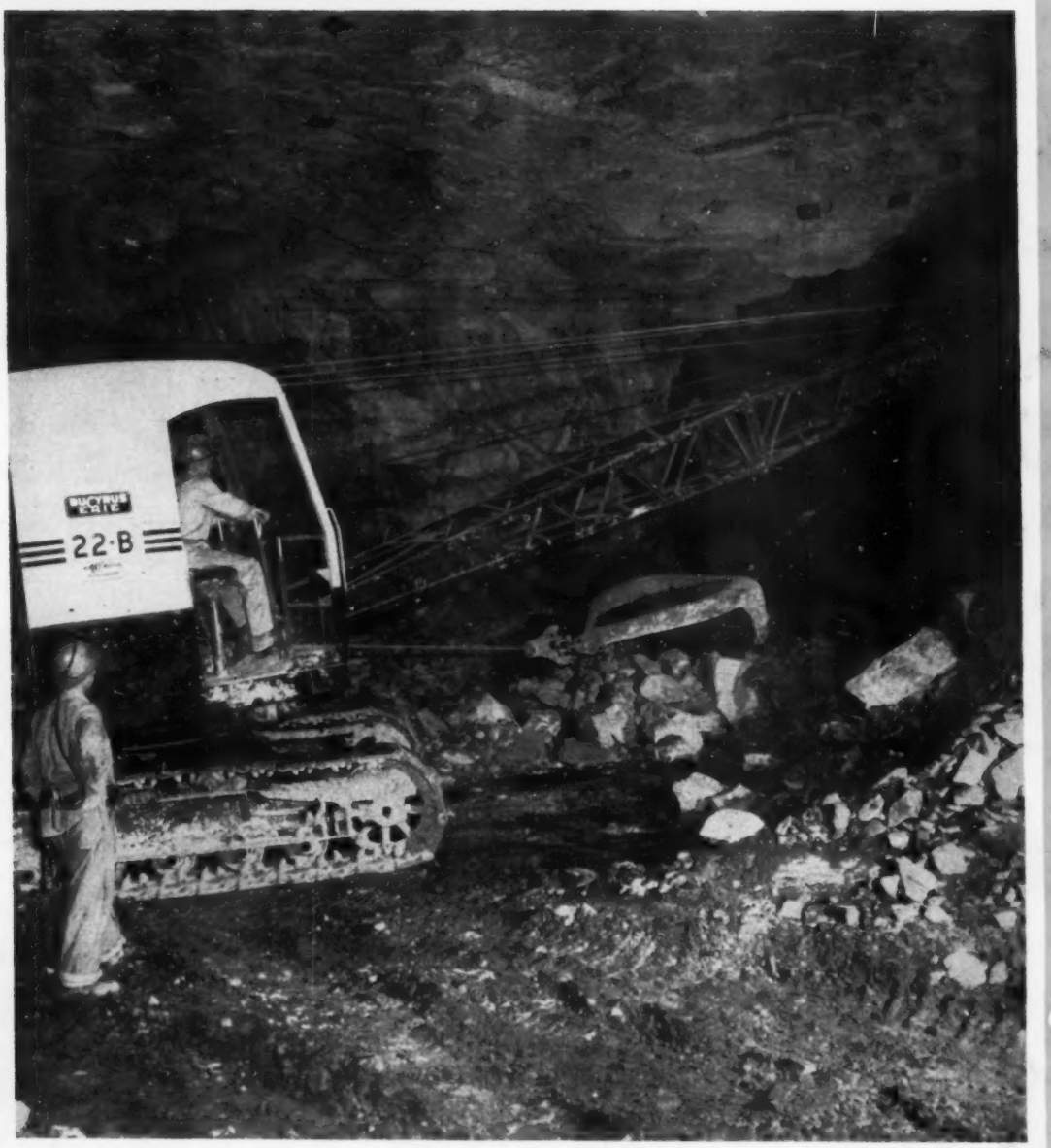
MAY 1957 Vol. 19 No. 6

MINING WORLD

Management Makes Bald Mountain Ore Pay Page 41

Seek Automatic Reagent Control at COMINCO Page 46



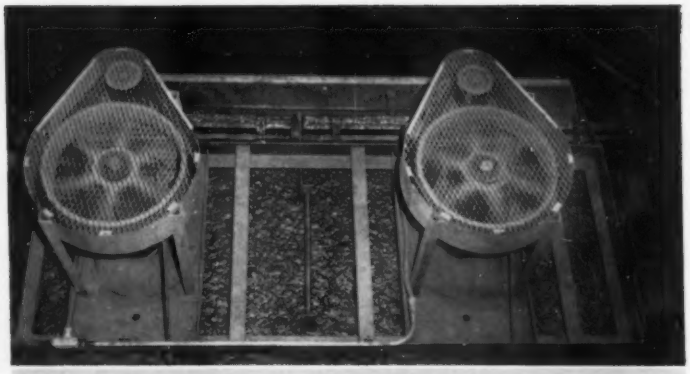
How Standard Uranium Mines High Pillars

Page 36

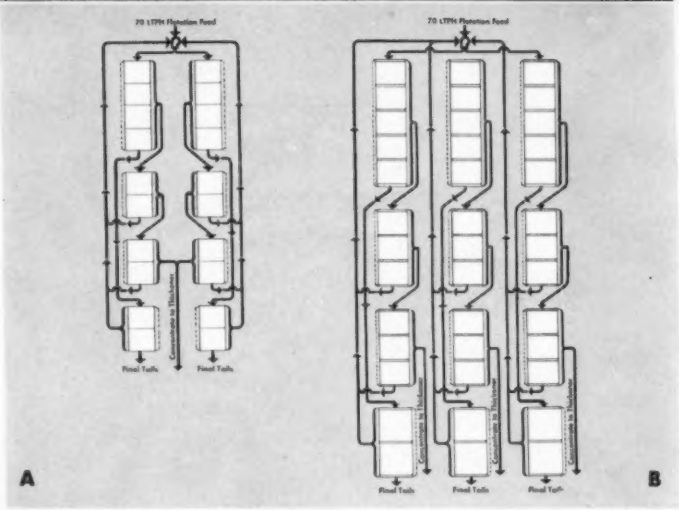
50 cents a copy—3s 6d in sterling

WEMCO

Fagergren Flotation 8 ways better!



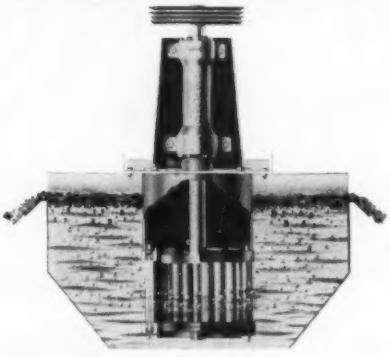
here's the proof: In an efficient new iron flotation concentrator, two parallel flotation circuits are used. Each receives identical feed, and each handles 70 long tons per hour with grade meeting market requirements. Check and compare these facts:



		Wemco Fagergren Units A	Other Flotation Units B
Circuit Characteristics	✓ Number of Cells	20	39
	✓ Gross Cell Volume[1]	1220 cu. ft.	2400 cu. ft.
	✓ Floor space (all cells)	644 sq. ft.	988 sq. ft.
	✓ Launder & Operating aisles (approx.)	167 sq. ft.	261 sq. ft.
	✓ Total Launder Length (approx.)[2]	225 ft.	373 ft.
Typical Metallurgical Results on This Type of Iron	✓ Units of Iron Recovered	1%-2% more	
	✓ Tailings Loss	1%-2% less	
	✓ Reagent Consumption	.2-.3 lbs. less per ton treated	

Notes: 1 – Taggart, Section 12 page 80, shows WEMCO-Fagergren efficiency of cell volume substantially greater than others, in addition to the above noted advantage in space alone.

2 – Shorter launder length in WEMCO circuit allows steeper slope; requires less wash water, causing less dilution of concentrate and minimizing dewatering requirements.



A reprint of the complete story is available for the asking. Write to:

WEMCO

WESTERN MACHINERY COMPANY
650 FIFTH STREET
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Atlas Copco produce world's lightest motor drill

From Atlas Copco, the world's largest manufacturers of pneumatic rock-drilling equipment, comes an entirely new motor drill. It is the Atlas Copco *Cobra*, backed by **50 years'** experience of rock-drilling equipment, and developed after extensive field tests.

Weighing a mere 53 **pounds, the** Atlas Copco *Cobra* is undoubtedly the lightest, handiest motor drill ever brought out. (The usual weight of a motor drill is around 80 pounds.) Yet despite its low weight the Cobra is able to put up a *higher footage* under actual working conditions than other, *heavier* motor drills. It is powerful, robustly constructed and, above all, *100 per cent self-contained!* One man can carry it and start it **up *anywhere*.**

New exclusive drill features

The Atlas Copco Cobra has 100 per cent air flushing from the built-in compressor. As no exhaust gases are used for flushing, troublesome de-carbonizing is eliminated. Another *first-ever* feature is the free-wheeling mechanism for easier starting and more rapid steel changes. The Cobra also incorporates a unique new method of automatic rotation of the drill chuck, a floatless carburettor enabling drilling up to a 45 degree incline and a pull-type starter. The Cobra drills 100 feet to the gallon, has a drilling rate of 26 feet per hour, and can drill holes up to 13 feet in depth.

The right steels for the Cobra

The Cobra—like all Atlas Copco drills—has been developed for use with *Sandvik Coromant* steels, the world's most widely-used integral drill steels. This, of course, adds considerably to the performance of the Cobra. *No drill or steel developed separately could possibly give such equivalent high results.* Atlas Copco drills fitted with Sandvik Coromant steels have proved an unbeatable drilling unit, responsible for the drilling of no less than one billion feet each year.

World-wide sales and service

The Atlas Copco Group embraces Atlas Copco companies or agents manufacturing or selling and servicing Atlas Copco equipment in ninety countries throughout the world. For further details of the equipment featured here, contact any of the addresses shown below.

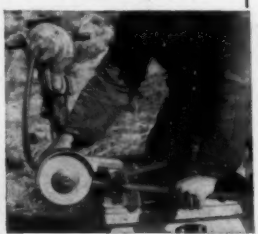
U.S. — Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA — Atlas Copco Canada Ltd., Montreal Airport, P.Q.

MEXICO — Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.

Motor Drill and Breaker in one!
The Cobra converts to breaker in minutes. Only three small parts to change. Reconversion just as quick.

Easily carried anywhere! *Perfectly-balanced carrying handle. Moulded back frame for transporting cross-country.*



Grinder driven from the Cobra! *A specially light drill steel grinder, powered through the crankshaft, can be supplied if required.*

DBS/61

Atlas Copco

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

MORE WORK-ABILITY

WITH THESE NEW "Euc" REAR-DUMPS

for construction, mine, quarry and industrial work

With overhung engine type tractors and full 90° hydraulic steering, these two new Euclid Rear-Dumps have excellent maneuverability for close quarter work and accurate spotting at loading and dumping areas. Big tires provide extra traction and flotation for soft fills and difficult hauls. The low over-all loading heights and rugged construction permit easy loading with all types of equipment. Smooth bodies with 3-stage, double-acting Euclid hoists assure quick shedding of loads.

Downtime and maintenance costs are held to a minimum as a result of the easy service accessibility of all major components. Interchangeability of the semi-trailer rear dump bodies with 7 and 18 yard scraper bowls provides extra flexibility for changing job requirements.

Your Euclid Dealer has detailed information on these versatile "Eucs" as well as other Rear and Bottom-Dump models, Scrapers and Crawler Tractors ... have him show you why ***Euclids are your best investment.***

EUCLID DIVISION, GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

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12 tons payload ...
11 cu. yds. heaped ...
143 h.p. ...
18.00x25 tires ... top speed loaded of 26.5 mph ...
5-speed transmission ...
NoSpin differential.

AND THE S-18 REAR-DUMP

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FOR MOVING EARTH, ROCK, COAL AND ORE

Mining World

Including the Export Edition **WORLD MINING**

Published monthly except in April when publication is semi-monthly

VOLUME 19 **MAY 1957** NO. 6

OPERATIONS-TECHNOLOGY

Mining

How Standard Uranium Recovers Pillars 36

By Russell L. Wood

The mining plan was carefully laid out with the complete extraction of pillars a major goal. To date 97.8 percent of uranium in the ore in place has been recovered from major stopes. Pillars to heights of 40 feet are regularly mined. A set of procedures has been worked out as a guide to other operators. This is first major pillar extraction job in the uranium industry.

Mining and Milling

Making $5.35 Gold Ore Pay at Bald Mountain 41

Good management holds mining costs to $2.90 per ton, milling to $1.65 at this small South Dakota gold mine. Four scattered mines feed one 350-ton-per-day straight cyanide mill. Proper selection of equipment, improved mining methods, and contract system are keys to low costs.

Large Scale Manganese Mining in Northern Rhodesia 50

Increased manganese output is coming from several open pit mines. Ore is washed, sorted, and jigged to yield a high grade concentrate for shipment.

Milling

COMINCO Seeks Continuous Automatic Reagent Control 46

Consolidated Mining and Smelting Company seeks reagent automation by measurement of residual xanthate content and pH of the mill pulp at its Sullivan zinc-lead flotation concentrator in British Columbia.

New Swedish Iron Ore Separation Plant 45

World's largest hoisting plant and dry magnetic concentration mill are now house in the same building at Kiruna, northern Sweden. The plant capacity is 4,600 tons per hour and makes five grades of concentrates.

Why Separan 2610 Cuts Uranium Milling Costs 53

This synthetic organic flocculant is now used at several Colorado Plateau mills to increase throughput at existing mills, lower new mill construction cost, decrease operating costs, and raise recovery.

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ON THE COVER

Standard Uranium Company uses this Diesel dragline for recovering pillar ore at its Big Buck mine in Utah's Big Indian district. Operator is under safe back but he can throw the bucket 50 feet ahead of machine and drag pillar ore out from under a dangerous caving back.

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A

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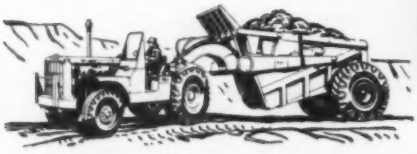
The Right Size and Type Rear Dump

for every tough mining job!

34-ton capacity PR21 - DW21, for maneuverability in tight quarters.



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34-ton capacity PR20 - DW20, for long hauls, high speeds.

New 31-ton Athey Hydraulic Ejection Trailer handles sticky, hard-to-discharge materials.

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Drifts and Crosscuts

Congratulations to 375 Park Avenue

The world's first bronze skyscraper will open at this New York City address of distinction this fall. This 38-story Seagram skyscraper is the first building to use architectural bronze for the exterior curtain wall. Copper alloys were chosen because they give an enduring natural color, and the sharp-edged mullions create sharp shadows lending third dimension to the façade. Of course, copper is used for piping, wiring, etc.

New Yorkers are prone to think of this as just another new building. It is only in the mining west that the true significance of this 5,400,000 pounds of copper (used in building) is realized. This is 2,700 tons which is worth $1,728,000 at the mid-April price of 32 cents per pound.

It takes a lot of men and equipment to produce this copper. Take the world's biggest copper mine—Utah Copper—where 16.6 pounds of copper were recovered per ton of ore mined last year. This one building took 325,301 tons of ore from Kennecott Copper Corporation's largest mine. Or consider that Anaconda Company's mine at Weed Heights, Nevada operated 30.7 days to produce this copper. Building copper is equivalent to 247 tons of 3.0 percent ore per day for an entire year.

So you see this one building makes a very good mine. The mining west salutes and thanks Seagram and the building's architects.

Add Page 54 To Your Yearbook

Yes, you are right, the MINING WORLD Yearbook which you have just received contained reports on mining developments and production figures from a smaller number of countries than normal. But, how many of you did notice that there were complete reports covering countries where political revolution and real shooting had taken place recently or was underway early this year. These countries included Egypt, Israel, Algeria, Cyprus, and Indonesia.

The difficulty in obtaining these reports was a challenge to the Editors who went all-out to obtain them for you. A typical letter from overseas outlining difficulties of the engineers at the scene said, "It has been much more difficult, due to the political events, to obtain documentation and for that reason also, as you will be aware, it is much less complete than for the past years."

Reports from other areas were delayed until final government production reports were completed and other information assembled.

To complete your copy of the Yearbook, tear out the special Yearbook appendix on page 54 of this issue and paste it in your Yearbook so that you will also have the record of mining in 1956 in Venezuela, Kenya, French Guinea, and French West Africa.

Mining Industry Loses A Real Friend

The untimely tragic death of President Raymon Magsaysay of the Republic of the Philippines is a cruel blow to the mining industry, the Philippine people, and the Free World.

He was a true champion of the Philippine mining industry and realized and outlined its importance in a special message to MINING WORLD readers in the September 1955 Philippine Mining Issue. He said, "We have to attract both foreign and local capital to invest in our mines. This we propose to do by enhancing further the favorable climate for investments here." There is no question of his success in doing this. The members of the Base Metals Association of the Philippines, Inc. pointed out how successful his policy was when they recently passed the following tribute "President Magsaysay was greatly responsible for the big progress achieved by the mining industry during the short span of his incumbency as the chief magistrate of the land."

Personally I have lost a friend. Never have I found anyone who inspired confidence, dignity, and authority in the manner that President Magsaysay did.

G. O. A., Jr.

For drifters, sinkers, stopers and jumbos . . .

New TIMKEN® threaded carbide bit

Has 5 new features to lower your cost per foot-of-hole

5 front holes clear chips faster. Water shoots directly forward with more velocity against the face, washing chips to the rear faster. Center plug is dropped deeper for freer cutting action, less drag. New frontal design *cuts your cost per foot-of-hole.*

Deeper, wider clearance between the wings works with five front holes to speed chip removal. Extra clearance permits water to carry chips away faster from the cutting face. Faster chip flow speeds drilling, increases efficiency. You get *lower cost per foot-of-hole.*

Deeper undercut under the heel provides even freer passage for washed-back chips. It reduces bit drag, increases bit life. This new feature, plus redesigned heavier wing, helps speed your drilling, *lowers your cost per foot-of-hole.*

Wear-resistant carbides give the new Timken® bit longer life. These special analysis carbides resist wear better, provide added shock-resistance. They can be reconditioned many times. Bit gives longer service life, you get *lower cost per foot-of-hole.*

Improved thread contact reduces breakage. You get longer bit life, *lower cost per foot-of-hole.* Write today for free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

THERE'S A TIMKEN BIT FOR EVERY JOB . . . EVERY DRILLING CONDITION

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NEW TIMKEN TAPERED SOCKET BIT

For air-leg drills and light stoping. Removable for full steel life, tapered for more secure union. Same new frontal features as threaded bit.

TIMKEN ***REMOVABLE ROCK BITS***

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Capitol Concentrates

Miners Watch Out For The Potential Dangers In Proposed Wilderness Areas

Proposed legislation to create a National Wilderness Preservation System should be watched by all who are interested in prospecting and mining. H. R. 361 by Representative O'Hara of Illinois, as well as several other identical bills, has been introduced which would establish the system to be "composed of areas in the United States and its Territories and possessions retaining their natural primeval environment and influence. . . ." Such areas would include (1) the wilderness, wild, roadless, and primitive areas as presently designated within the national forests; (2) designated units within the National Park System, wildlife refuges and ranges, and Indian reservations with consent of the tribal council; and (3) such other areas as shall be designated in accordance with the act by the Secretary of Interior, Secretary of Agriculture, Presidential order or proclamation, or Act of Congress.

No portion of any area within the system could be devoted to "community production, to lumbering, prospecting, mining or the removal of mineral deposits (including oil and gas), grazing by domestic livestock, water impoundment or storage, or to any form of commercial enterprise except as contemplated by the purposes of the Act." A National Wilderness Preservation Council would be created to perform certain functions including coordinating the administering agencies and obtaining cooperation between federal and state agencies, organizations, and individuals concerned.

Forest Service officials have stated emphatically that they do not wish nor propose to hinder prospecting or mining in any way. We accept these statements without hesitation and would worry about it no further if we could be assured that the future administration of the proposed wilderness areas would be under the sole jurisdiction of the present Forest Service personnel and policies. However, if such legislation is enacted, then the proposed wilderness areas, if established, would be included automatically under the national system with all its restrictions, or they could be put there at the drop of a hat. The proposal is potential dynamite.

• State and Treasury Stall Mineral Program

An authoritative leak in Washington confirms the rumors that the Interior Department actually has drafted a long-range mineral policy. What sort of a policy it is still remains under the veil of secrecy.

In speculating about the long awaited long-range minerals program for domestic producers, and the reports that it must be cleared by the State and Treasury Departments, the disturbing thought must occur to those most concerned that the State Department probably would reject any effective quota or tariff protection; the Treasury Department would probably reject any effective tax remission; and assistant secretary for Mineral Resources Felix Wormser has spoken out publicly against subsidies, as well as warning that there would be no short-range or immediate relief involved. If these things be true, it strains the imagination to conceive what sort of watered down nonsense the Secretary of the Interior will have to present to the Congress. The White House is reported to be greatly embarrassed by the delay in formulating a practical program—and well it might be.

• Mercury Program Is Extended

The Office of Defense Mobilization recently announced that its mercury program, scheduled to expire in December 1957, would be extended to December 1958. However, the size of the program through 1958 will be reduced and will call for the purchase of only 50,000 flasks, 30,000 from domestic sources and 20,000 from Mexico.

The initial program authorized the purchase of 125,000 flasks from domestic producers. The price, however, was so low that only a token offering of five flasks was acquired by the government. If current market prices prevail through 1958, it is unlikely that there will be any purchases from domestic sources unless ODM raises its $225.00 per flask offer. The market price at present is in the neighborhood of $255.00 per flask.

• Mineral Programs Caught In Budget Cutting

The House of Representatives in its effort to show the President a few things about cutting the budget (after he threw the responsibility on the Congress) has gone hog-wild in attacking mineral purchase programs. First, the Kirwan subcommittee on Interior of the House Appropriations Committee struck out all funds to operate the mineral purchase program under Public Law 733, $30,000,000 from the Urgent Deficiency bill and $40,000,000 from the fiscal 1958 Interior Department budget. Then the Thomas subcommittee on Independent Offices started operating on the budget for the national stockpiles. The President asked for $359,000,000, which the subcommittee reduced to $19,000,000, barely enough to continue stockpile administration, whereupon the House, by voice vote, knocked off the remaining $19,000,000, leaving absolutely nothing in the budget for stockpiling in the 1958 fiscal year.

The Senate Appropriations Committee restored the $30,000,000 in the Urgent Deficiency bill for mineral purchases and the Senate agreed, but at this writing the conference committee has reached no decision on the restored funds. No doubt the Senate Appropriations Committee will attempt to restore some funds for the national stockpile, but whether or not the House will stick to its shortsighted position is hard to say at this time.

• Support For Quota Plan Is Growing

The idea of imposing import quotas to protect various American industries seems to be gaining momentum in the Congress. The scheme is believed practical when dealing with certain types of imports. It should be remembered, however, that the target

Continued on page 105

THIS D4 DIGS OUT $33,000 WORTH OF TURQUOISE A YEAR

You're looking at some of the richest rock in Colorado. Here, northwest of Villa Grove, gem turquoise comes out in chunks valued from $30 to $150 a pound. To get it, the Villa Grove Turquoise Lode Co. uses this husky Caterpillar D4 Tractor with No. 4A 'Dozer.

On a good day this D4 'dozes a hundred tons of rock and overburden and moves them a distance of some 200 feet. Last year it carved out over $33,000 worth of turquoise.

Owner M. C. Winfield chose the CAT* .D4 Tractor for this job because he liked its power. There's 50 drawbar HP in this machine, with a maximum drawbar pull of 10,700 pounds. There's sturdy quality built into every inch, from the long-life track pins and heavy-duty track rollers all the way into the rugged, dependable transmission. And Caterpillar's famed oil clutch, job-proven by thousands of hours of hard-working service, is available now on the D4. Other important features include an exclusive all-weather starting engine (it gets mighty cold up in this Colorado country!) and a fuel injection system that squeezes power from every drop of low-cost, non-premium fuel.

Your Caterpillar Dealer will be happy to demonstrate the D4—or any other of his big yellow machines—right out on your job. He's the man to call for expert service, too, and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

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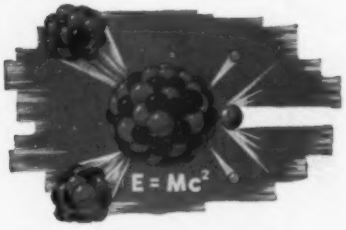


FISSION FACTS

Monthly Roundup of Mining News In the Atomic Energy Field

France Tops West Europe In Uranium Production

France is reported to be the leading producer of thorium-bearing ore in the word, and the largest producer of uranium in Western Europe. Known reserves of uranium ore in France amount to 100,000 tons, and 10,000 tons of this are under development. In the French territory of Madagascar there are reserves of 1,000 tons of the uranium-bearing ore, thorianite ($Th{\cdot}U{\cdot}O_3$).

Several discoveries of uranium deposits have been made recently in France. Traces of ore with better average uranium content than that found in the German Black Forest, and nearer the surface, have been found near Wisembach and Gerardmer in the Vosges, and near Facogney and Servance in the Haute-Saone.

In Alsace, three deposits have been found in the Saint-Hippolyte region, at Trou-au-Diable, Schaentzel, and Tannenkirch. They are just below the surface of gravel beds.

Construction work on a French center for nuclear studies was begun late in 1956 at Grenoble, in the French Alps. This will be the second such center in France.

Experts From Americas Discuss "Peaceful Atom"

An Inter-American Symposium on the peaceful applications of nuclear energy will be held May 13 through 17 at Brookhaven National Laboratory, Upton, New York. It is jointly sponsored by the United States Atomic Energy Commission, the Department of State, and the International Cooperation Administration.

From the 21 American Republics, close to 100 Latin American leaders in the field of nuclear energy have been invited to participate, in addition of a group of United States scientists who are specialists in various aspects of the civilian nuclear energy program.

Following the five-day symposium, the participants will tour AEC facilities, hospitals, universities, and industry to observe the peaceful atom at work in the United States.

Phillips Finds Major U_3O_8 Body; Plans 1,500-Ton Mill

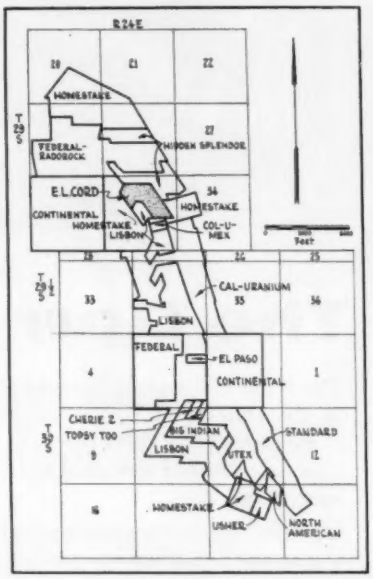
The Phillips Petroleum Company has submitted a formal proposal to the United States Atomic Energy Commission for building a 1,500-ton-per-day uranium mill in the Ambrosia Lake district of New Mexico. This confirms industry reports that Phillips for some months has been planning such a mill and needed an AEC purchase contract for yellow cake from the mill.

Ore for the mill will come from a new mine now being developed by Phillips on a 1,250-acre lease in Section 28, T. 14 N., R. 9 W., McKinley County. Phillips has developed more than 2,800,000 tons of above average grade ore by an extensive surface drilling program. The ore is about 700 feet below the surface and averages 10 feet thickness. Holly Minerals Corporation originally owned ¼ interest in the lease but in late 1956 Phillips paid $1,750,000 for Holly's interest. Phillip's drilling has been very successful and by July 1956 more than 100,000 feet of hole indicated 500,000 tons of ore. By September of last year 1,500,000 tons were indicated and by April of this year the 2,800,000 tons had been indicated.

Drilling has been extended to the southwest on Section 34, T. 14 N., R. 9 W. in the hope of extending the proven limits of the ore body. Another drilling program is underway calling for 25,000 feet of hole in Section 36, T. 15 N., R. 10 W. on land leased from Strategic Metals Research Corporation, Producers Uranium Company, Mayflower Uranium Company, and Congress Uranium Company. This drilling is 4½ miles northwest of the Phillips shaft. The ore horizon is about 1,400 feet deep. Initial drilling is reported to have found no mineralization.

Phillips has also established an exploration camp and started drilling on a 51,000-acre lease from United Western Minerals Company, Norbute Corporation, J. H. Whitney & Company, and others, about 25 to 30 miles east of Ambrosia Lake and 18 miles north of Anaconda Company's Jackpile mine.

Big Indian, Utah Mine Sells for $17,000,000



The largest uranium mine purchase in the United States has been made by Jen, Inc., a privately held company, from E. L. Cord Partnership. Location of the Cord mine in the north end of Utah's Big Indian district is shown as the dotted area on the accompanying map. Jen, Inc. is headed by E. H. Snyder, Nevada and Utah mining leader (chairman of the board); C. E. Tuttle, Baltimore, Maryland financier and former head of the Pittsburgh Railroad and Coal Company (president); E. H. Snyder, Jr. (vice president); and C. M. Christensen of Salt Lake City, Utah (secretary-treasurer). Directors of Jen include Jess Larson of Washington, D. C., and David J. Stone of Lubbock, Texas. Mr. Larson is former head of the General Services Administration, and the Defense Materials Procurement Agency.

Cord Partnership which sold the mine for $17,000,000, with payments extending over a period of several years, had been developing the mine for the last three years. Mr. Cord formerly operated gold mines in California and Nevada. His associates include Norman Biltz, John Mueller, and Ben Edwards of Reno, Nevada.

The ore body was discovered by surface diamond drilling following favorable ore discoveries in the adjacent claims. Cord Partnership then contracted for a 670-foot-deep, three-compartment shaft with Boyles Brothers Drilling Company of Salt Lake City. More than 2,000 feet of drifting and cross cutting has been done in the ore body to confirm diamond drilling which indicated 500,000 tons of ore. Production since November 1956, mostly from development headings, has reportedly been 5,000 to 6,000 tons of 0.70 percent U_3O_8 ore per month. This ore has been shipped to the Atomic Energy Commission's mill at Monticello, Utah under a contract which expires at the end of July. Insomuch as Mr. Snyder is also chairman of the board of the Uranium Reduction Company which operates the nation's second largest uranium mill at Moab, it seems probable that Jens' ore will be treated by Uranium Reduction in the future.

Under the direction of mine manager George Teal, exploration and mine development will be pushed.

The map shows the location of claim holdings in the district. The original discovery was made by Charles Steen on the Utex Exploration Company claims. As he developed the Mi Vida mine, a camp was established with Mrs. Zeke Johnson as cook. Mr. Steen told her of some favorable ground to the north. She and her husband staked this ground and subsequently sold it to the Cord Partnership.

Utex Exploration Company, Standard Uranium Corporation, Homestake Mining Company (three mines), Federal Uranium Corporation, Hidden Splendor Mining Company, and Lisbon Uranium Corporation have all developed ore bodies. Cal Uranium Corporation's claims are controlled by the Federal group.

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. . . higher capacity wet screening in the 8-48 mesh range with

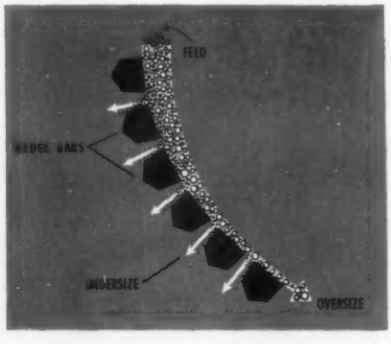
The Dorr-Oliver DSM Screen

The latest and one of the most significant advances in the Dorr-Oliver line of classification equipment is the Dorr-Oliver DSM Screen . . . developed for the high capacity wet screening of materials in the 8-48 mesh range.

Capable of handling exceptionally large flow volumes, the DSM Screen will effect separations at capacities greatly in excess of other units now operating in this size range. The compact and economical stationary design requires very little floor space . . . no special support required other than that for piping. Installation and operating costs are low . . . no moving parts result in minimum maintenance.

Available in four standard sizes from 1 to 4 ft. in width the DSM Screen can provide from 200 gpm per ft. width of 48 mesh undersize to 500 gpm per ft. width of 8 mesh undersize.

For more information on this newest tool for the mining industries, write for a copy of Bulletin No. 2300. Dorr-Oliver Incorporated, Stamford, Connecticut.



Illustrative drawing showing principle of separation

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HD-21 crawler tractor, 204 net engine hp
315 scraper, 20 yd heaped, 15 struck

YOU CAN STRIP OVERBURDEN AND RECLAIM LAND PROFITABLY

with this crawler tractor-scraper team

There is a marked trend toward reclaiming worked-out pits—and a parallel trend toward the use of Allis-Chalmers crawler tractors and scrapers. Both are examples of wise management.

Land Reclamation—eliminates to a large extent the scarred and worthless landscapes left by abandoned pits and piles of overburden. Properly reclaimed land usually returns far more than the cost of reclamation in higher resale value. Even where pits can be only partially filled, the land may be seeded profitably for pasture.

Allis-Chalmers HD-21 Crawler Tractor and 315 Scraper are ideal for this type of operation. This team is mobile and flexible enough to strip overburden and spread it immediately in a worked-out area of the pit. This eliminates the need of re-handling overburden and of calling in specialized equipment.

Curved and offset cutting edge on the scraper, plus torque converter drive on the tractor, are just two of many features that put this Allis-Chalmers team in a class by itself for this type of work. Let your Allis Chalmers construction machinery dealer give you the details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

NORDBERG MACHINERY

. . . used by leading TACONITE producers

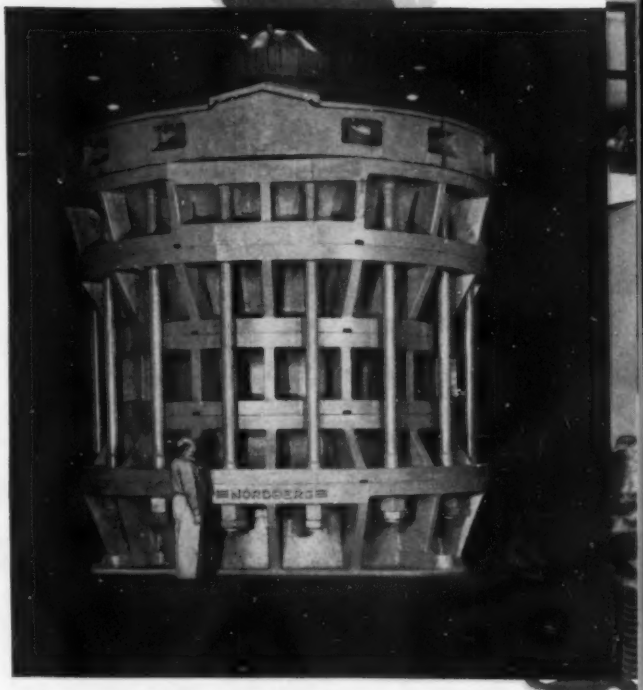
To provide adequate iron ore reserves for today's increased steel production, the large-scale beneficiation of Taconite ore has become imperative.

Long used in the economical production of Taconite concentrates in the Arctic region of Norway, Nordberg Machinery is now serving the huge Taconite operations in northern Minnesota . . . where a new era in U.S. iron ore production is now underway.

The selection of Nordberg Machinery for the processing of the extremely hard Taconite ore again follows the trend of the mining fraternity to rely on this heavy duty machinery for its proven ability to reduce ores and minerals at low per ton cost.

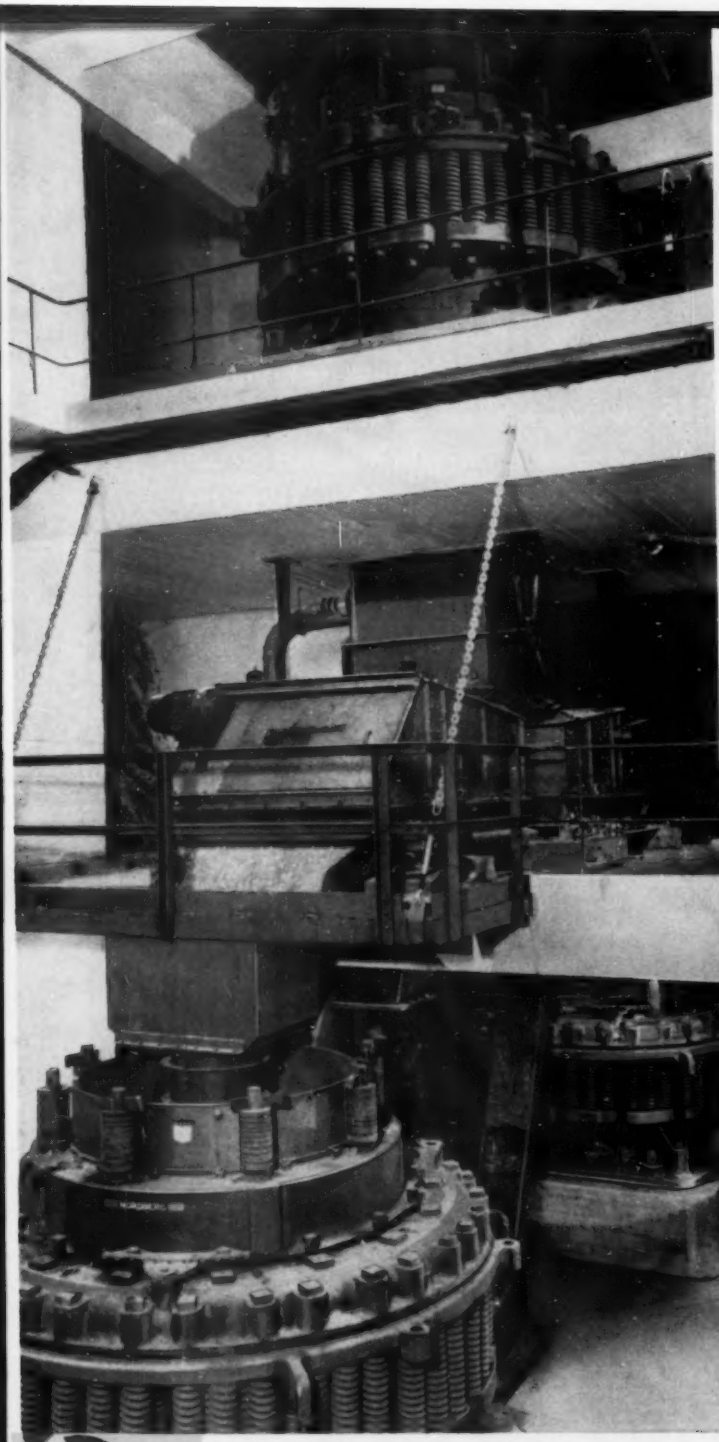
Nordberg Machinery now in use by leading Taconite producers includes Symons® Primary Gyratory Crushers, Symons Cone Crushers, Nordberg Rod and Ball Mills, and Symons Rod Deck Screens.

While *your* crushing and processing problems may not involve Taconite, you may be sure that Nordberg machinery is the logical choice for practically any other ore and mineral processing operation where big tonnages at low cost are required.

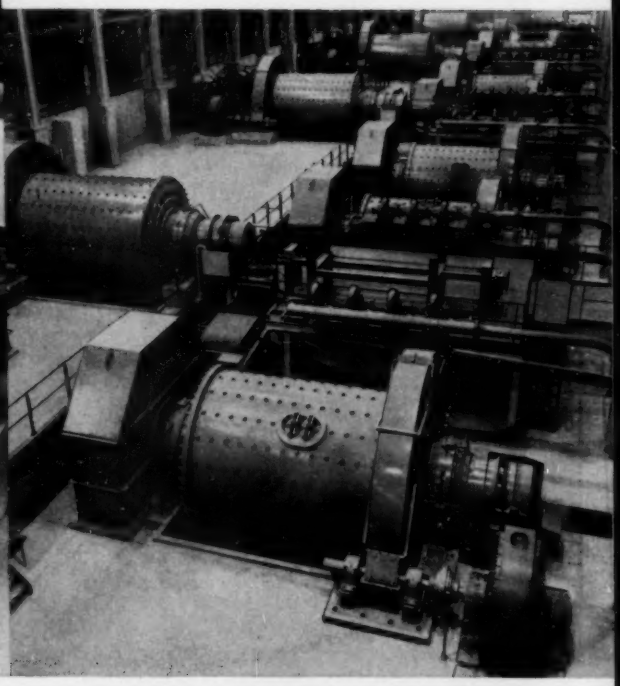


This Symons Primary Gyratory Crusher has a feed opening of 54" and capacity of 2000 or more tons per hour of hard, abrasive Taconite ore. Symons Gyratories are built in sizes up to 72" feed openings, with capacities of over 3500 tons per hour.

NORDBERG MFG. CO., MILWAUKEE,



Typical arrangement of Symons Cone Crushers and Symons Vibrating Rod Deck Screens installed for secondary and tertiary crushing, and screening of Taconite ore. Cone Crushers of this type are built in sizes up to 7′ diameter, with capacities to over 900 tons per hour.



Battery of four Nordberg 10½′ x 16′ Rod Mills and eight Nordberg 10½′ x 14′ Ball Mills installed in a large Taconite concentrating plant. Other Nordberg Grinding Mills are built in sizes from 6′ to 13′ diameter and up to 50′ in length in Rod, Ball, Pebble, Tube and Compartment types.

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Coal cutters, and all other powered mining equipment, such as loaders, feeders, shuttle cars and drills, work toward the one big goal of safer, more economical production. Simplex-TIREX cords and cables are helping to achieve this goal in mines everywhere. They offer maximum flexibility, and their jacket of cured-in-lead Neoprene Armor resists abrasion, oil, heat and water, and gives longest life.

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Wire sculpture by Henry Szafarz

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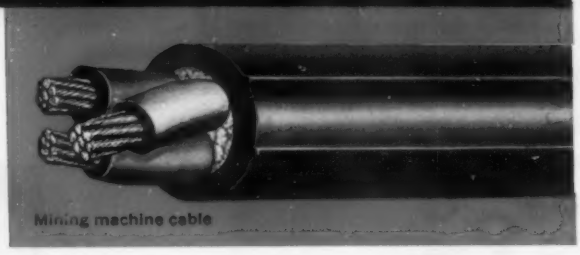

Mining machine cable

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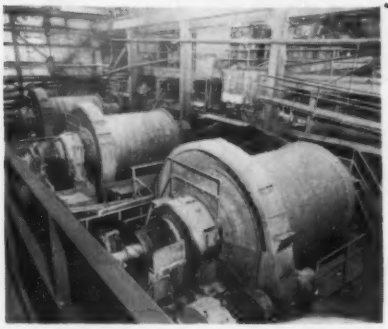
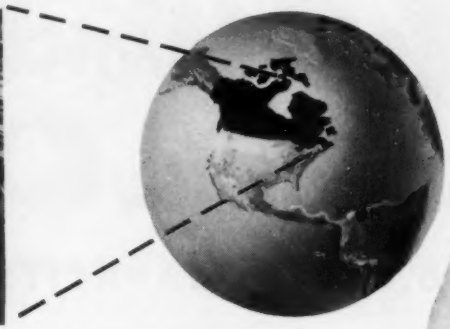
YES, WHEREVER THERE'S MINING, you'll find the successful companies using *Marcy Mills.* The fact that these companies throughout the world continue *reordering* Marcys is evidence of Marcy's low-cost-per-ton production and dependable mechanical operation.





The Quemont Mining Corporation, Noranda, Quebec, has a 9' x 12' Marcy Rod Mill and five 9' x 12' Marcy Ball Mills in its copper-zinc-gold mill. These mills were sold, manufactured and serviced by Mine & Smelter's licensed manufacturer and sales representative, Canadian Vickers, Ltd., Montreal. The Quemont mills are just six of more than 150 Marcys in Canada.

One Reason...*proper design and the best worldwide manufacturing facilities.*

For more than 40 years Mine & Smelter has specialized in the design and manufacture of grinding mills. This *experience* has resulted in a selection of materials and a type of construction which assure long, trouble-free operating service, minimum maintenance, and maximum convenience in installing, aligning, and operating the mill.

It is equally important to you to have available good manufacturing and service facilities, as provided by our U.S. plant . . . and our foreign manufacturers and representatives, who are experienced mining people backed by excellent shop facilities. You can depend on them to do a good job.

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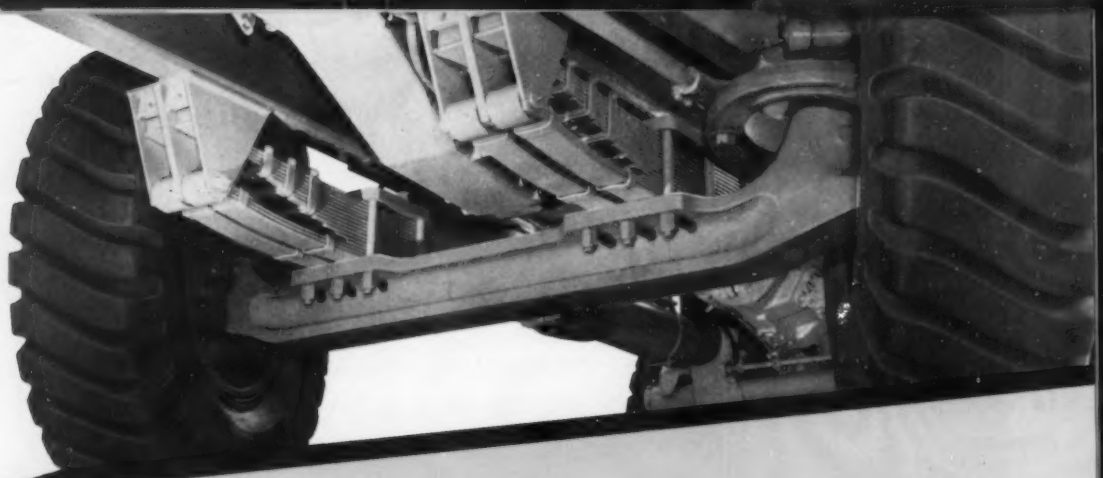

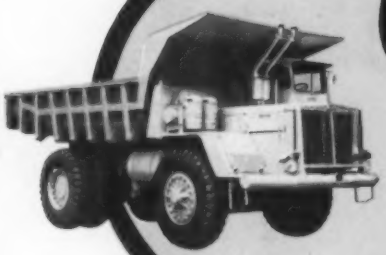

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50,000 LB. CAPACITY FRONT AXLE

Kenworth's 803 end-dump is built big all over—from its variable section frame to its all-welded steel body. And, this is especially true of the 50,000 lb. capacity front axle. Completely Kenworth engineered and built, this front axle has an 8" heat-treated, alloy steel, I-beam center section; 3" diameter king pins with nylon bushings, and 6" diameter spindles at inner wheel bearings. Over the roughest terrain, where an ordinary heavy-duty axle would not stand the going, this one has strength to spare. That's typical of all Kenworth's spring-mounted rock and ore movers—every one built for big loads and rough roads. There's one for your job—from the 36-ton Kenworth 803, to the 18-ton 801, the 24-ton 802, the 48-ton 802-B, or the 64-ton 803-B. Ton for ton, each of these rugged rock and ore movers is engineered in every detail for greater strength, lower maintenance, longer life. Now's the time to help yourself to consistently increased profits—learn why . . .

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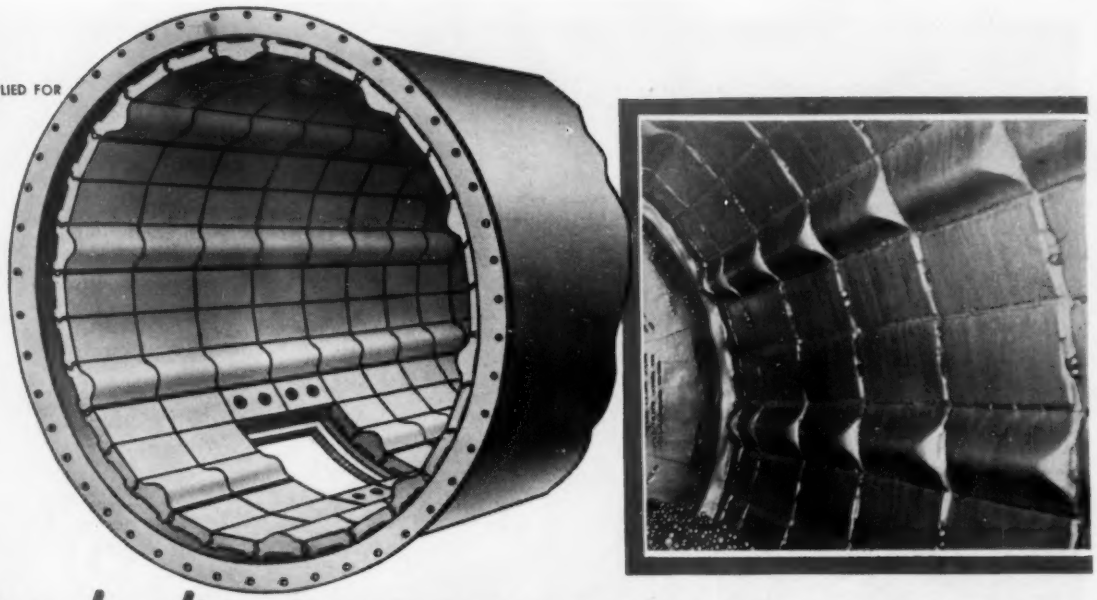

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B&W LINER PLATES RAISE PERFORMANCE, LOWER COSTS

The new B &W Tube Mill Liners have advantages that mean reduced costs in capital, time and labor.

Cost per ton of material ground is reduced, for the practical reasons listed below. Check them—you may find that one, or a combination, of these qualities will solve your existing problems.

- Lower Initial Costs—No pattern and chiller costs —the result of standardization.
- Longer life of liners—Uniform wear will result from better quality control on a mass production casting, utilizing permanent molds. Size is ideal for uniform chill and heat-treatment.
- Longer life for different applications can be realized by a selection of proper materials. This design lends itself to either chilled irons or wear steels.
- Direct labor cost and the "down-time" to install the liners are reduced. Castings are easily handled due to small size and weight. Less fatigue of workers. No cranes needed to handle lightweight liner castings.
- Cost reduced for storage space. Minimum storage space required as small castings "stack" easily. Records simplified with one design of casting interchangeable for all size mills.
- Saves money on liner inventory. One design fits all diameters of mills, permitting standardization. Quicker unloading and storage possible.
- Savings in breakage claims and delays for replacements. Hard brittle irons are frequently broken in shipment when large castings are used. Small castings are rugged and almost impossible to break by handling.
- Savings in determining most efficient wear pattern. Same castings will produce wear profiles consisting of all lifter ribs, all flats or combination of both, including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates, write The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.

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BOILER DIVISION

S-464

Locomotive operator moves and loads the trip by off-track control located at chute

They chute rock into S-D Automatics and get a One-Man Haulage System!

This metal mining company installed these S-D Automatic Bottom Dumping Mine Cars at a new mine after experiencing the economies of S-D Automatic One-Man Haulage at one of its older operations . . . including years of service proving that S-D Automatic sides and doors daily take the beating of large chunks of rock loaded from chutes. There, on a 3,000-foot-long-haulage, one man and a locomotive with six S-D Automatics load and transport the entire daily tonnage, averaging 850-tons and handle all men, supplies and miscellaneous services.

If all this equipment were abandoned and trackless haulage was substituted even without cost, they could not afford to convert this system to trackless methods or any other kind of haulage, the reason being apparent!

S-D Automatics dump and re-close automatically on-the-move, without extra labor, into any size storage bin — the key to economical transportation of any material.

Because the same tremendous reduction in cost per ton is available, we believe the day is coming when bottom dumping mine cars will be as popular in metal mining as they are in the bituminous coal industry today. As the super market for all types of mine cars, we believe our experience with the designs of every type of car haulage is of value to you. When we state S-D Automatics are worth looking into, we mean that, with few exceptions, S-D Automatics provide the most efficient and by far lowest cost method of main line haulage! Together we can intelligently discuss your present or anticipated future requirements as to how much S-D Automatics can save you! Our invitation to help you is genuine. May we hear from you?

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The Engineer's Field Report

CASE HISTORY
LUBRICANT RPM Delo Oils
FIRM Progressive Transportation Co., Compton, California

RPM DELO holds piston wear to .001" after 201,253 miles of on-and-off highway hauling

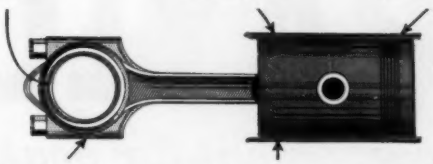
LUBRICATED WITH RPM DELO Oil, these engine parts were pulled from a Cummins HR diesel after 201,253 miles. A portion of this mileage was put on during four months of rugged service spotting loads of heavy pipe in the Arizona desert. When the engine was taken down, after two years of this on- and off-highway hauling, Progressive Transportation Co. found RPM DELO Oil had kept lacquer, gum, sludge, and deposits from forming...rod bearing wear varied between .0005 and .001 inch and pistons showed maximum wear of only .001". No wear at all evident on main bearings. Progressive Transportation uses RPM DELO Oils in all its large fleet of tractors—some of which have traveled well over 200,000 miles without overhaul.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

Detergent keeps all parts clean



Metal-adhesion qualities keep oil on parts in running or idle engines—inhibitor resists foaming

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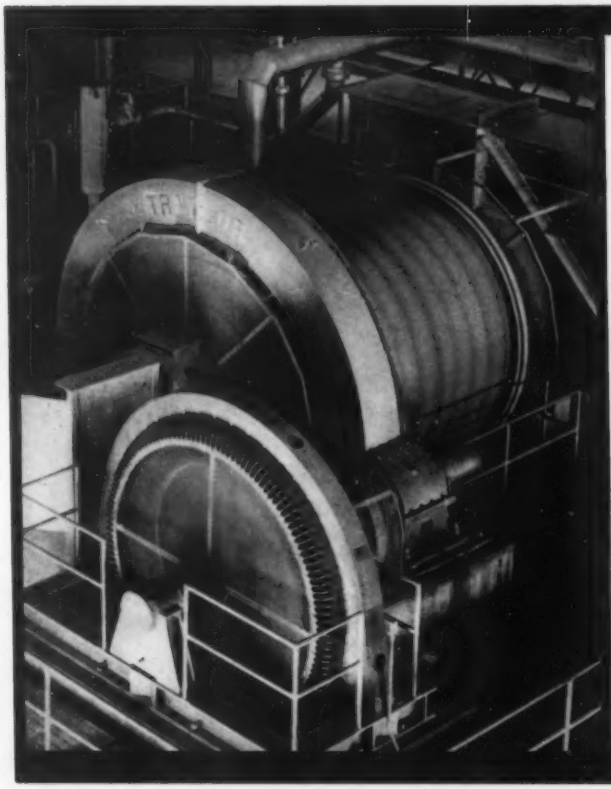
the expert fisherman
has his rod custom-made
because he gets
something **EXTRA**



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Leading producers rely on the proven features of Traylor-made Mills to achieve EXTRA production efficiency and lower operating costs.

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TRAYLOR-MADE

equipment for peak performance

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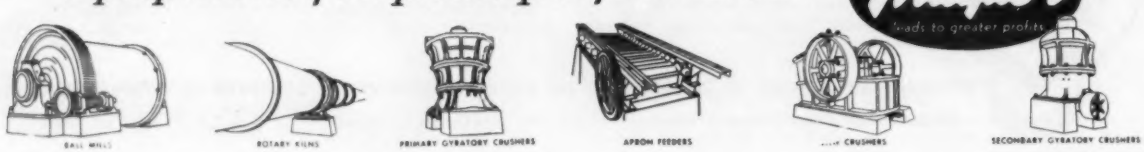

This 150-B is one of several Bucyrus-Erie electric shovels working at a large open pit copper mine in Montana.

In Montana . . . and the World Over Bucyrus-Erie Electric Shovels are a First Step to Profitable Production

Opening a new pit or working an old one, Bucyrus-Erie shovels can be depended upon to help hold mining costs in line. Here in a big Montana open-pit copper mine, they deliver big yardages economically day in and day out.

These machines are engineered specifically to meet today's high production demands. The exclusive front-end design, with two-section boom and tubular dipper stick, reduces weight and assures plenty of strength for tough digging. Because there is less deadweight, swing speeds are faster and there are more payloads every hour. Powerful main machinery is easily accessible for servicing. Exceptional smoothness and ease of operation result from Ward Leonard electric controls.

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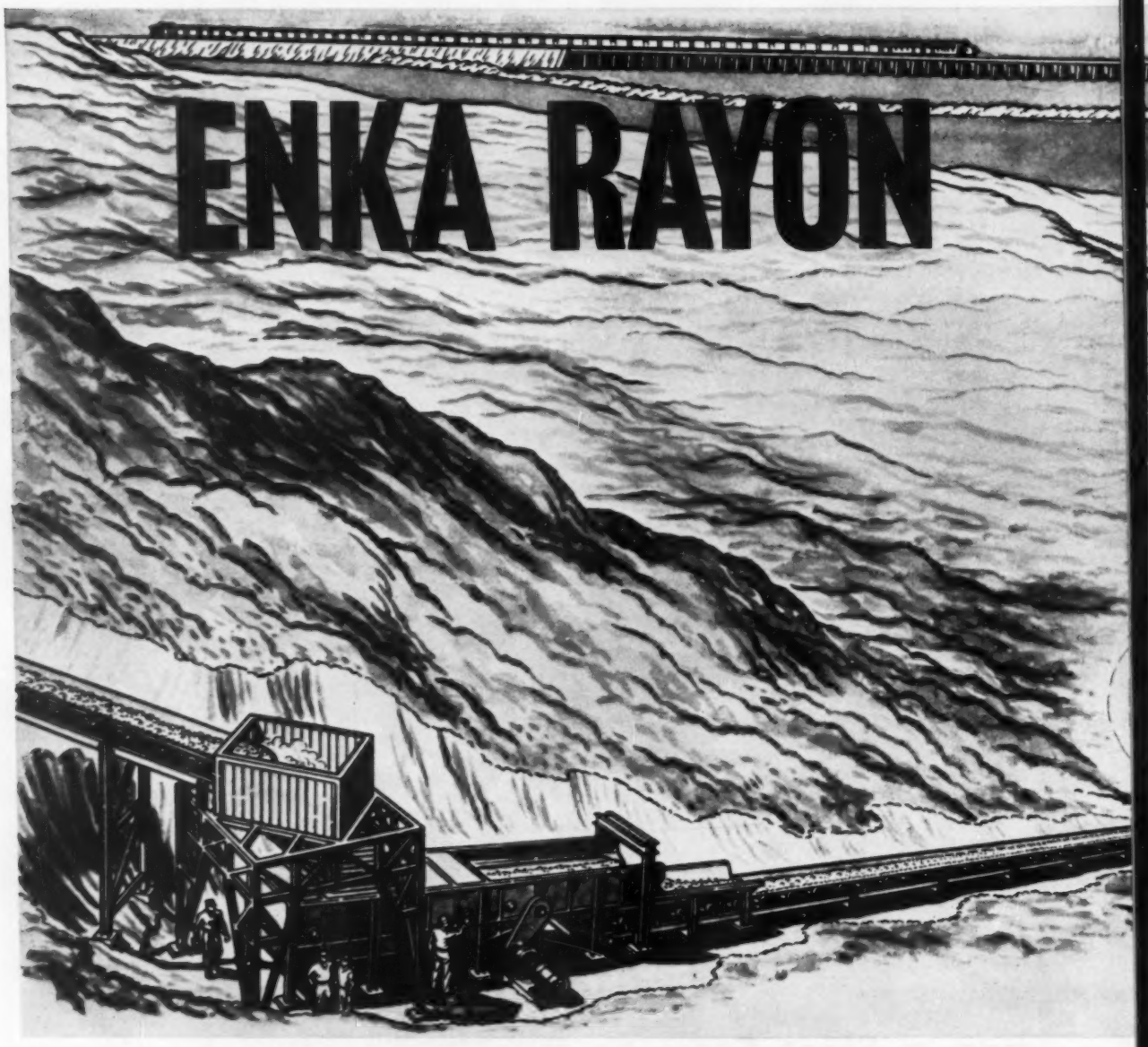

helps to build a 13-mile causeway

AMERICAN ENKA CORPORATION

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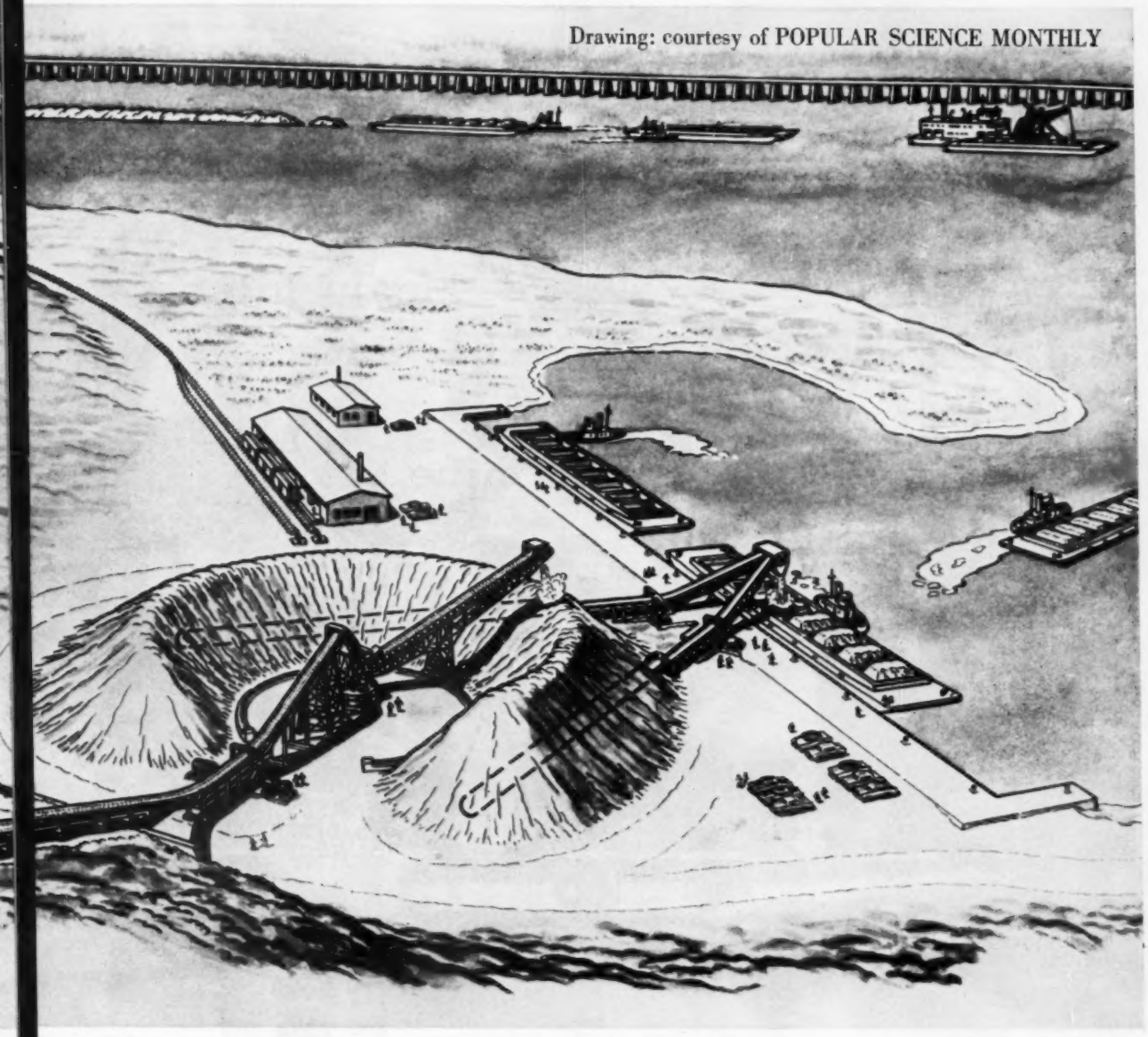
530 Fifth Avenue, New York 36, New York • 428 Jefferson Standard Building, Greensboro, North Carolina
871 McCallie Avenue, Chattanooga, Tennessee • 2001 Industrial Bank Building, Providence, Rhode Island

Drawing: courtesy of POPULAR SCIENCE MONTHLY



across the Great Salt Lake

Enka—
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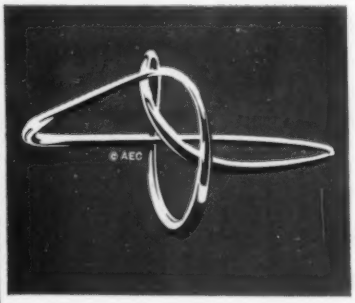
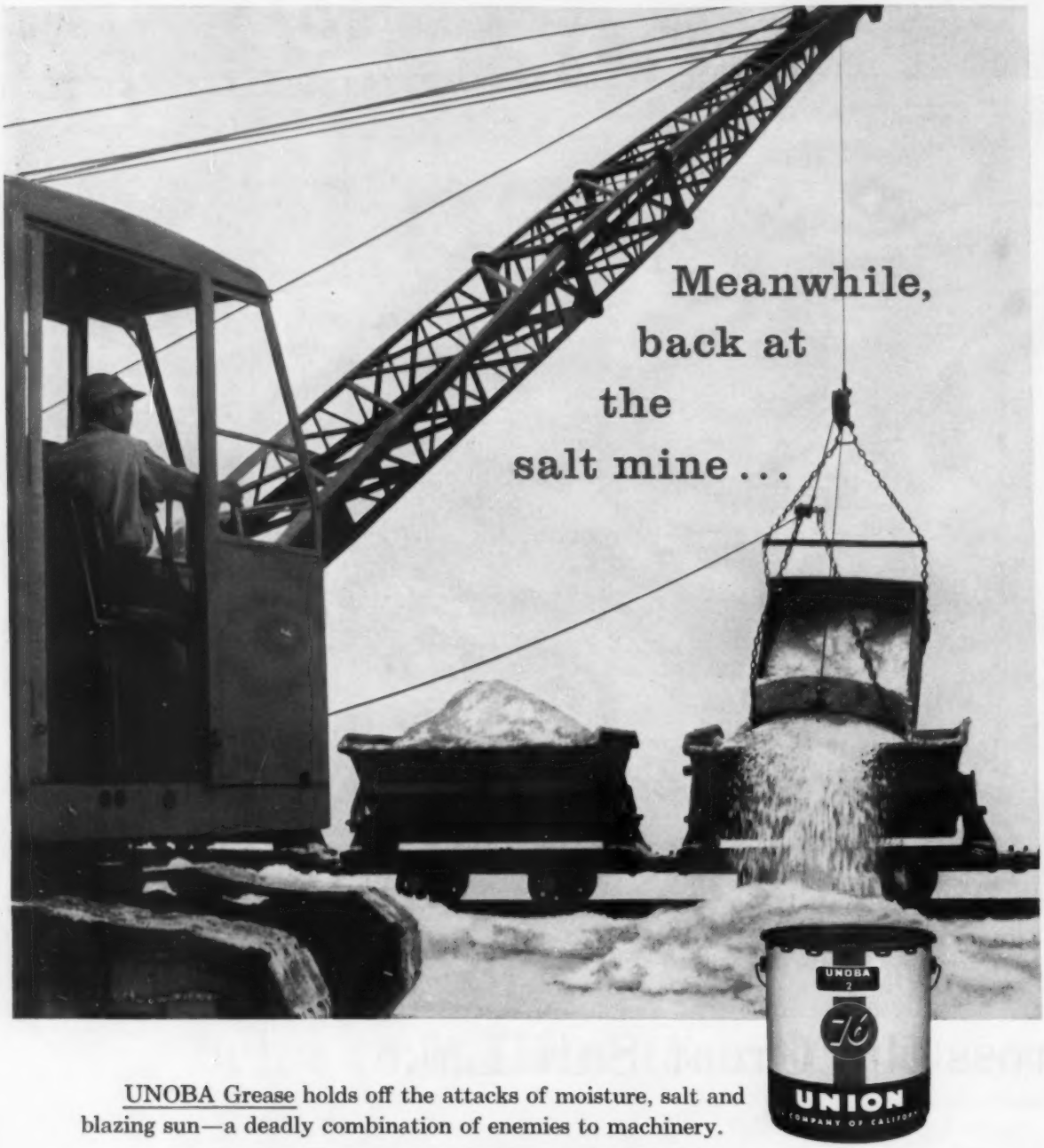
and service in
synthetic fibers



Hewitt-Robins has specified Enka High Tenacity Rayon in the 1.8 mile conveyor belt system for Southern Pacific. In this installation, Enka Rayon is delivering top performance with economy at a record 8,800 ton-miles-per-hour. Enka Rayon combines remarkable strength and durability with flexibility, exceptional resilience, tension and abrasion resistance. This means that by specifying Enka High Tenacity Rayon in your conveyor belts you get the above advantages and you get them at lower cost. Call or write for further information.



UNOBA Grease holds off the attacks of moisture, salt and blazing sun—a deadly combination of enemies to machinery.

In fact, Union's remarkable barium-lithium base UNOBA Grease has kept these ornery critters at bay year after year after year for this western salt-producer.*

For the lubricant that will protect your machinery under the most hostile attacks of weather, heat or corrosion, signal your nearby Union Oil representative for multipurpose UNOBA Grease. He's as prompt with help as the United States Cavalry.

* *Name on request*

UNION OIL COMPANY OF CALIFORNIA

The West's Oldest and Largest Independent Oil Company

ANOTHER CATERPILLAR FIRST!

CERTIFIED POWER

FOR CAT* DIESEL ENGINES

CATERPILLAR TRACTOR CO.

ENGINE POWER CERTIFICATION

This is to certify that the Diesel Engine herein described has been engineered, manufactured and tested in accordance with rigid Caterpillar Standards. The materials and workmanship incorporated into this engine give it the inherent capacity for satisfactory performance when applied in accordance with the power ratings established and recommended by this company. The MAXIMUM OUTPUT capacity of this standard production engine is 200 H.P. @ 2000 R.P.M. equipped with: air cleaner, water pump, lubricating oil pump, fuel pump, and standard intake and exhaust manifolds.

I certify that B. L. Henson, Supervisor of Diesel Engine Test, Caterpillar Tractor Co., [illegible] Certification and I affix my [illegible] /58

B. L. Henson
Supervisor Diesel Engine Test
Caterpillar Tractor Co.
Peoria, Illinois

Caterpillar Model D326 Industrial was manufactured and shipped as follows: Engine Serial No. 39B1018 Shipping Date February 11, 1957

Power Setting 152 H.P. @ 1600 R.P.M. Intermittent Power Rating

Additional Equipment:

- Radiator & Fan
- Ether Starting Aid
- 32V Charging Generator
- Governor Control
- Tachometer Drive
- Muffler
- Heater Connections
- Remote Shut-off

POWER RATINGS

MAXIMUM OUTPUT is the horsepower capacity of the engine; a measure of the maximum power, ± 5%, that can be developed for five minutes without drop in speed.

INTERMITTENT HORSEPOWER is a rating for use in variable load applications such as excavators, hoists, and standby power units, where the duration of sustained full power output is one hour or less, with the average output not over 80% of Intermittent Horsepower.

RATED HORSEPOWER is a rating for use in applications such as planing mills, hammer mills, and rock crushers where the duration of sustained full power output is 12 hours or less.

CONTINUOUS HORSEPOWER is a rating for use in applications such as work-boats and pumps where the duration of sustained full power output is 24 hours per day, day in—day out.

Horsepower figures are established in accordance with rigid Caterpillar standards. All ratings, corrected to sea level barometric pressure (29.92 in. Hg) and standard temperature (60°F), apply to a production engine including air cleaner, water pump, lubricating oil pump, fuel pump and standard intake and exhaust manifolds. The above ratings are based on British and American BHP.

Printed in U.S.A.

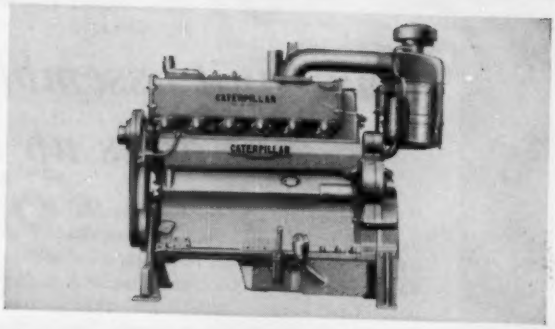
FORM NO. 215-52553

In a quarter century of diesel leadership Caterpillar Engines have achieved a reputation for *honestly rated power*. Owners have found that they can depend on a Cat Diesel to deliver the power promised.

Now, to back this reputation, Caterpillar becomes the *first* manufacturer to issue a certificate showing the horsepower capabilities of the engine. This certificate is signed by Caterpillar Tractor Co. and certified by a notary public.

You have a right to demand *certified power* when you invest in an engine. You get it when you buy from your Caterpillar Dealer. Let him show you the certified power plant that fits your needs.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.



CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

why "unit assembly" construction adds up to MORE TRIPS PER HOUR

Your choice of an Ingersoll-Rand double or triple drum Scraper Hoist . . . either air or electric . . . adds up to *more* trips per hour, less maintenance and longer hoist life. Each unit consists of its own barrel-type housing, rope drum, gearing and clutch which operate independently. This means you can select the right combination of pulling power and speed. It also means that return rope speeds are at least ⅓ faster than pull rope speeds.

Selection of the right scraper hoist for your job is easy when you choose from the wide range of "Unit Assembly Hoists". Write for Bulletin 5300A. Engineering help on your scraper mucking problems is available for the asking—no obligation.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-532

Heavy-duty Adams grader improves, maintains haul-roads . . . smooths plant area. Better roads pay off in faster, lower-cost hauls from mine or pit to plant.

Big ALL-JOB grader

extra power for heavy-duty grade work

Here's a BIG grader with work-capacity to match . . . a machine that handles all grade work at lowest cost. It's the 150 hp Adams 660 . . . a 30,200 lb. machine geared to fast, modern work methods.

15 speeds boost output

Adams 660 really makes the dirt "fly", with more power-speed combinations than any other conventional transmission grader. For your *normal work-range*, "660" gives you 4 full-power forward speeds (2.3 to 6.7 mph) instead of 3. It provides 2 reverse-work speeds as against the usual 1. You get "just-right" power and speed for all every-day blading operations.

Three optional *creeper speeds*, as slow as 36 feet per minute, provide extra "muscle" for rugged work . . . controlled power for precise blading and work in rocky soil.

Add to this *high travel speeds* (forward and reverse) that cut-down wasted time . . . add *productive* minutes for *haul-road maintenance*. 4 forward gears (10.3 to 26.0 mph) speed maneuvering, make hill climbing easier, cut travel time. And "660's" 2 faster reverse speeds (to 13.7 mph) save many turn-arounds . . . give up to 30% bonus production on one-way work.

Positive controls speed blading

Your operator works faster, more precisely with smooth Adams blade controls. Three-jaw clutches engage without chatter or kick-back. Direct-drive power is applied steadily. Your operator can *depend* on blade operation at constant speed — no matter how many other controls are actuated. There's no vibration because all clutches, gears, shafts, and universal-joints move on anti-friction bearings.

Attachments widen work-range

There are a number of *specialized* attachments you may want to add to the "660" . . . now or later: *Scarifier* for opening-up clay, rock-filled soil, or old roadways . . . *push-plate* for push-loading scrapers, or starting stubborn equipment . . . *bulldozer blade* for odd-lot casting and back-filling . . . *Elegrader* for stripping topsoil, loading dirt, casting ditch-material, building up roads . . . *snow equipment* for winter snow removal work.

Also, 190 hp "660" with torque converter

For maximum push-power at all speeds between 0.0 and 27.4 mph, LeTourneau-Westinghouse offers the new POWER-*Flow* 660. This super heavy-duty grader applies 190 hp thru torque converter to give you the effective work-power of an *infinite* number of power-speed combinations. POWER-*Flow* 660 plows thru varying loads at constant speed . . . will not stall . . . starts extra-heavy loads without lugging. Torque converter cushions engine and drive against shock . . . makes operation simpler, more efficient.

Write for more facts

Write us for more information on Adams motor graders available in 6 sizes, 60 to 190 hp. These machines work faster, cut deeper, blade truer, complete more work than any other grader of similar size and power. In the 190, 150, 123, 115 and 80 hp sizes, you have a choice of GM or Cummins diesel engines.

This fast-moving Adams grader keeps pit floor clean . . . saves wear on fleets' tires and treads. Permits driving haul equipment by shortest routes, and improves drainage.

Adams, POWER-Flow—Trademark AG-1223-M-bw-6

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

How a midwest steel producer

TRIPLED TRACTOR-SHOE LIFE

It's "tough-going" in a slag pit! Heavy loads, the grinding impact of abrasive rock and metal, really put tractor shoes to the test. And that's exactly what this steel producer did.

Amsco® cast Manganese Steel Tractor Shoes were installed in place of rolled shoes. The result: *a 3-time increase in service life.* While rolled shoes had previously been replaced after one season's service, the Amsco pads lasted nearly *3½ years—a total of 3374 service hours.*

Here's further proof that Amsco Manganese Steel—"the toughest steel known"—can save you money and replacement time wherever severe impact and abrasion are a problem. Call your nearest Amsco representative, or write us direct, for further information on Amsco Tractor Shoes.

Amsco Manganese Steel Tractor Shoes
In addition to excellent impact and abrasion resistance, Amsco Tractor Shoes have countersunk bolts. This means less wear on bolts, often saves bolt-replacement when changing pads.

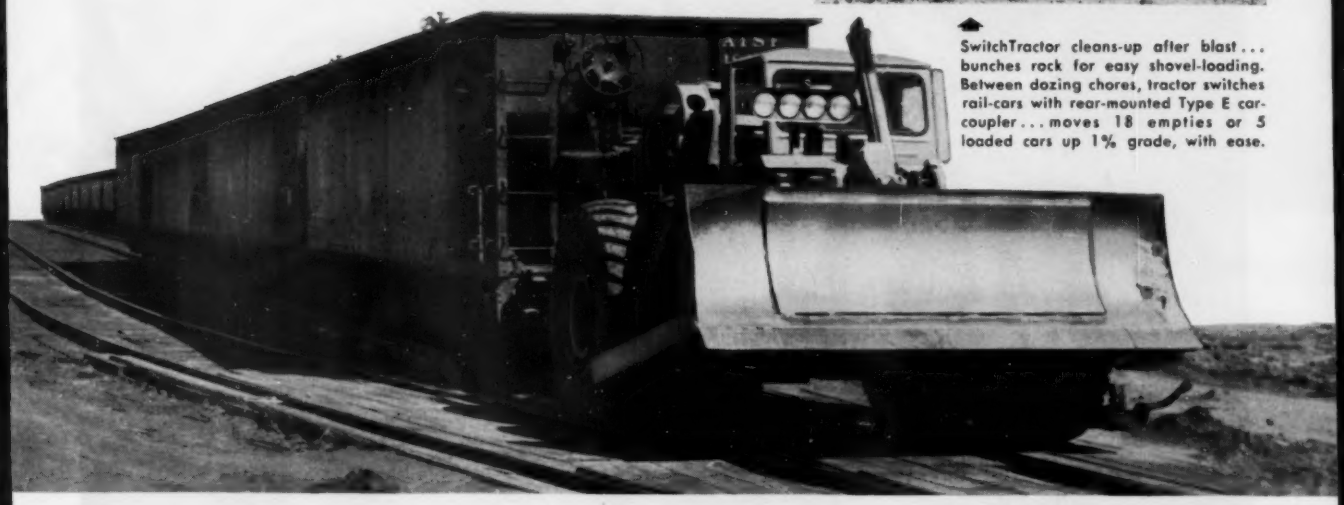
AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS; JOLIETTE, QUEBEC

Double-duty tractor



SwitchTractor cleans-up after blast... bunches rock for easy shovel-loading. Between dozing chores, tractor switches rail-cars with rear-mounted Type E car-coupler... moves 18 empties or 5 loaded cars up 1% grade, with ease.

SwitchTractor moves rail-cars, does regular tractor work

Here's a big, 208 hp rubber-tired tractor that does double-duty by also switching railroad cars. With its 17 mph speed, and go-anywhere mobility, SwitchTractor works fast ... often switching "for free" in spare time between tractor chores.

Tournatractor with car-coupler

Cost-cutting SwitchTractor is a regular LeTourneau-Westinghouse Tournatractor—fitted for operation of dozer, angledozer, snow plow, and other attachments. In addition, it is equipped with a standard Type E railway coupler attached on the rear. SwitchTractor can either *pull* a string of cars with its coupler... or *push* them with dozer blade; can safely spot or "hump" cars on many widely scattered tracks in a minimum of time.

Switch-engine, not tied to tracks

This 208 hp go-anywhere switcher-dozer is always ready to shift rail-cars wherever needed. Rolling on big rubber tires, it maneuvers quickly from spur to spur... moves back and forth between pit, bench, stockpile, plant, dump, or other location. It travels via roads or cross-country ... always takes the fastest route.

When switching cars, SwitchTractor straddles the rails (6'4" between tires), rolls on tie-ends and ballast. It gets better traction, can *pull twice as many cars* as an on-track switcher of the same weight. Big, low-pressure tires do not damage ties, rails, switches, or pavement.

Saves time on tractor work

Double-duty SwitchTractor also dozes, pulls, and pushes faster than crawlers. Practical work-speeds to 7.5 mph, and top-speed of 17.2 mph, let you handle more plant clean-up and pit maintenance. You build and keep haul roads smoother, open snowed-in roads earlier. You handle shovel clean-up promptly and effectively, spread waste on dumps faster, move utility equipment easier.

On push-and-return work SwitchTractor's constant-mesh transmission with air-actuated clutches, alone, gives you up to 8 minutes extra production per hour. It saves up to 5 seconds, each gear-shift... makes no stops for shifting, loses no momentum... changes direction or gear-ratios *instantly*. In addition, torque-converter (standard equipment) provides uniform and most effective engine speed — with automatic rationing of wheel speed to load — for maximum efficiency in application of power.

Go-anywhere mobility widens work-range

Because 17 mph SwitchTractor *travels job-to-job twice as fast* as crawlers, it works more productive hours per day... services more pit operations, gets to work faster, handles more work over a wider range of travel. It requires no special planking for moves... no flatbed-hauler, trucks, and extra help.

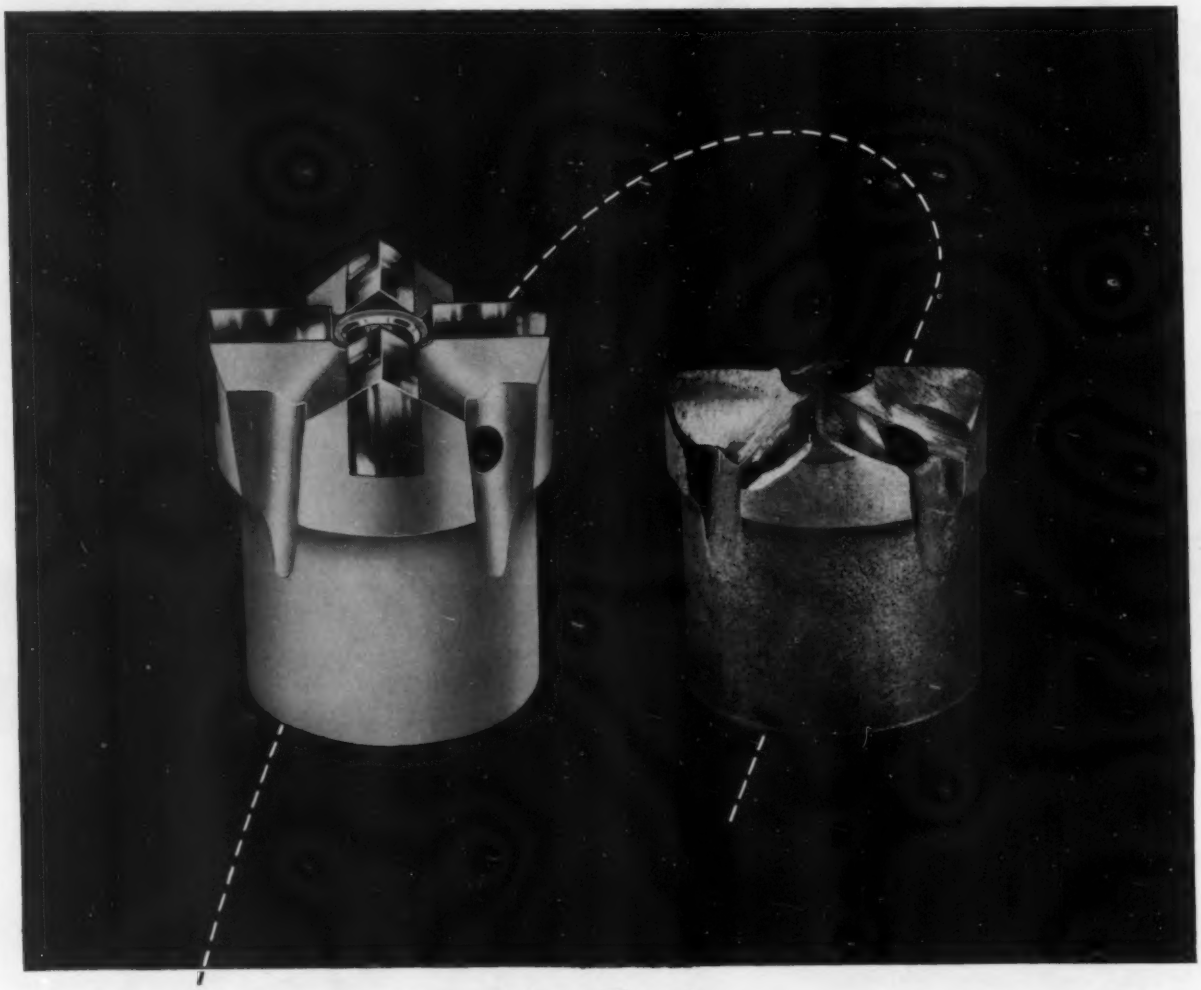
This rubber-tired L-W SwitchTractor is a two-way money-saver for mine, quarry, or pit. Call or write for complete details and prices.

SwitchTractor—Trademark; Tournatractor—Trademark Reg. U.S. Pat. Off. ST-1355-M-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



THIS JOY BIT DRILLED *46% Farther*... STILL MORE TO GO

YOU'LL FIND YOUR BIT SIZE IN THIS CHART

SHOULDER DRIVE	BOTTOM DRIVE	TAPER SOCKET
1½"		1¼"
1⅝"		1⅜"
1¾"		1½"
1⅞"		1⅝"
2"		
2⅛"	2½"	
2¼"	2¾"	
2⅜"	3"	
2½"	3¼"	
2¾"	3½"	
3"	4"	
3½"	4½"	
4"	5"	
4½"	5½"	
	6"	

Note: Shaded areas are X-Type, others are Cross Type

WRITE FOR FREE BULLETIN 172-8

Drilling Rock with a scleroscope hardness of 90-100 takes a lot out of most carbide bits . . . on this job, other bits were averaging 532 feet. Our illustration shows a Joy bit before and after drilling almost 800 feet in this formation. The average for Joy bits on the entire job was 781 feet.

Here's why: OFFSET WINGS allow drag-free rotation, faster removal of cuttings, easy reconditioning . . . DEEP SLOTTED CHIP WAYS allow cuttings to escape; bit does not regrind its own cuttings . . . INSERT STAYS IN because of new brazing method . . . SPECIAL ALLOY STEEL BODIES heat treated for shock resistance and high fatigue life . . . PRECISION MILLED THREADS instead of tapped threads.

These are the reasons why Joy tungsten carbide bits give extra footage . . . and only Joy bits have all these features. Let your Joy representative prove it to you. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW C 6595-172

JOY ... EQUIPMENT FOR MINING ... QUARRYING ... CONSTRUCTION

Portable Air Compressors

Wagon Drills

Drilling Bits

Hand-Held Rock Drills

With high apron lift and positive ejection tailgate, electric control B Tournapull with Fullpak Scraper spreads heaping load fast in controlled layers.

BIG B FULLPAK*

delivers more pay-yards... at lowest-net-cost-per-yard

The new LeTourneau-Westinghouse 27-yd. B Tournapull® with Fullpak Scraper has the *capacity, speed, power,* and *stamina* to deliver more pay-yards at lowest-net-cost-per-yard—lower than any of today's big production scraper units. The big "B" incorporates the same high-production design test-proven by its popular companion, the 18-yd. C Tournapull. Check these important B Tournapull advantages:

√ **Loads faster** — Dirt flow into new B Fullpak bowl is nearly horizontal, since bowl bottom has only 1° rise. Giant scraper packs full capacity, low-void payloads fast. With shallower, broader bowl, less force is required for *lifting* material to heap bowl — as with boxy high-sheeted scrapers. That means more power can be applied to *cutting* and *pulling*. Also, low push-block speeds load by giving direct-line thrust from pusher to blade.

√ **Boils better** — B Fullpak tailgate has curved top, to roll material forward into the heap — filling all corners and around apron. Crowned side-sheets reduce spillage, help deflect material into all corners.

√ **High apron lift** — 7'1" apron lift speeds loading and unloading of chunky material. Smooth streamlined side-arms and side-sheets prevent chunks from being trapped.

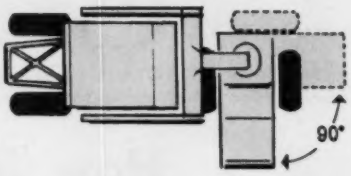
√ **10 speeds** — Choice of 10 speeds forward (from 2.6 to 28.4 mph) . . . plus clutch brake for fast shifting . . . means hauling at higher speeds, more trips per hour. Low-gear matches pusher speed, enables 293 hp "B" to help itself in loading, gives maximum power for pulling through soft footing.

√ **Faster, easier servicing** — All working parts of B Fullpak are easy to get at and service in the field. Fewer fittings and check points reduce lubrication time. Big 27.00x33 low-pressure tires have ample load-carrying capacity, are interchangeable all around.

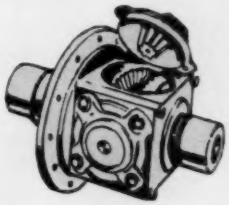
For complete details

These and other exclusive LeTourneau-Westinghouse features give you high-efficiency on your production earth-moving for big construction jobs. No other big-capacity scraper can match Fullpak's combination of advantages. Call or write for complete details.

Other profit-producing features on the new B Tournapull



90° turns . . . with electric power-steer, through geared king-pin, permit Big "B" to make non-stop U-turns in area less than its own length . . . less than the turning diameter of a pick-up truck.



Power-transfer differential . . . automatically transfers power from slipping wheel to wheel with best footing. With Tournapull you travel safely through soft, spongy spots with smooth, even application of power to tractive conditions.

Exclusive Fullpak Scraper design . . . gives faster loading, better boiling. Diagram shows how lower push-block carries pusher thrust direct to blade for fast cut.

*Trademark BP-1404-G-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

JAEGER "600" ROTARY easily powers dual 4" drill rig in 18' limestone ledge at Nelson Brothers quarry, Lathrop, Kansas. Compressor maintains plenty of reserve power behind the drills at characteristic slow, economical operating speeds.

How Jaeger air cuts drilling cost

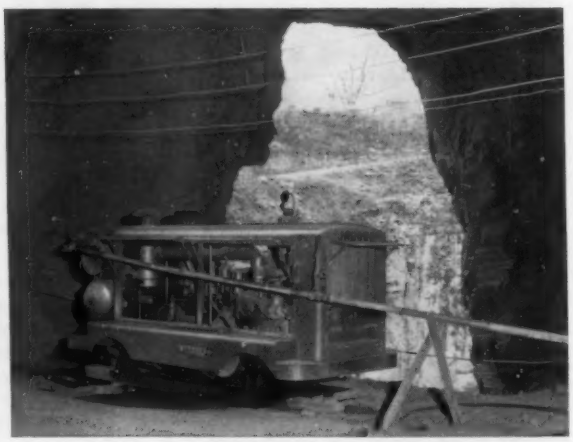
Same mobile "600" saves money in quarry and on 450,000-ton excavation for Turnpike

With its Model 6-71 GM diesel engine easing along at fuel-saving speeds that never reach 1650 rpm, this truck-mounted Jaeger "600" rotary compressor powers two 4" drills at top production efficiency in limestone quarry supplying concrete and road aggregates.

Over long hours of steady drilling, the slow-speed, efficient operation of the Jaeger "600" (1650 rpm full load speed instead of 1750-1800) means substantial savings in fuel and engine and compressor wear. These savings were repeated when Nelson Brothers, the owners, shifted their mobile rig to a 450,000-ton rock excavation project for the Kansas Turnpike.

Slow-running, efficient performance, resulting in fuel economy, fewer fpm of engine piston travel and thousands fewer compressor revolutions per hour, is characteristic of all Jaeger rotaries. Smaller units (125, 250 and 365 cfm) deliver full volume at 1700 rpm versus 1800 to 1950 rpm in similar compressors having no more than equal, and often less, air capacity.

It will pay you to make your next compressor a Jaeger. Call or visit your Jaeger distributor for full details and prices, or write us for Catalog JCR-5.



LOGS 400' (IN 12'-18' DEPTHS) PER 8-HOUR SHIFT, IN HARD MISSOURI LIMESTONE: Using only 36 gallons of fuel per 8 hours, Jaeger "600" powers two 4" drifters to this average daily production in Federal Materials Company underground quarry, Cape Girardeau, Mo. Jaeger slow-speed, high efficiency performance saves fuel and wear on every job.

THE JAEGER MACHINE COMPANY

667 Dublin Avenue, Columbus 16, Ohio

PUMPS • CONCRETE MIXERS • SPREADERS • FINISHERS • TRUCK MIXERS

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

Now Commercially Available-- A More Economical Flocculant AEROFLOC® 550 Reagent

Cyanamid is pleased to announce a lower-priced, efficient flocculant —AEROFLOC 550 Reagent—to replace both AEROFLOC 548 and 552 Reagents with consequent savings to its customers.

Extensive laboratory testing and plant usage have indicated that AEROFLOC 550 Reagent is just as effective a flocculant as the products it replaces. In addition, increased production and improved manufacturing techniques have made possible substantially lower prices on AEROFLOC 550 Reagent—in the 58¢ to 63¢ per pound range, F.O.B. Woodbridge, New Jersey or F.A.S. New York, depending upon quantity and packaging.

Chemically AEROFLOC 550 Reagent is the same synthetic polymer as AEROFLOC 548 and 552 Reagents. It also has similar physical properties. Performance-wise AEROFLOC 550 Reagent is equal to or better than AEROFLOC 548 and 552 Reagents. Consequently, no changes in feed rate, solution strength or other operating procedures are involved in the change to AEROFLOC 550 Reagent.

AEROFLOC 550 Reagent is most effective on slime suspensions having a pH of 5 or above. For acid circuit flocculation, AEROFLOC 3000 Reagent is recommended.

Cyanamid field engineers will be pleased to furnish samples for test and to quote upon your requirements.

NORTH AMERICAN CYANAMID LIMITED
160 Bloor Street East, Toronto 1, Ontario, Canada

CYANAMID DE MEXICO, S. A.
Apartado No. 26012, Mexico 12, D. F., Mexico

CYANAMID OF GREAT BRITAIN, LTD.
Bush House, Aldwych, London W. C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7852, Johannesburg, Union of South Africa

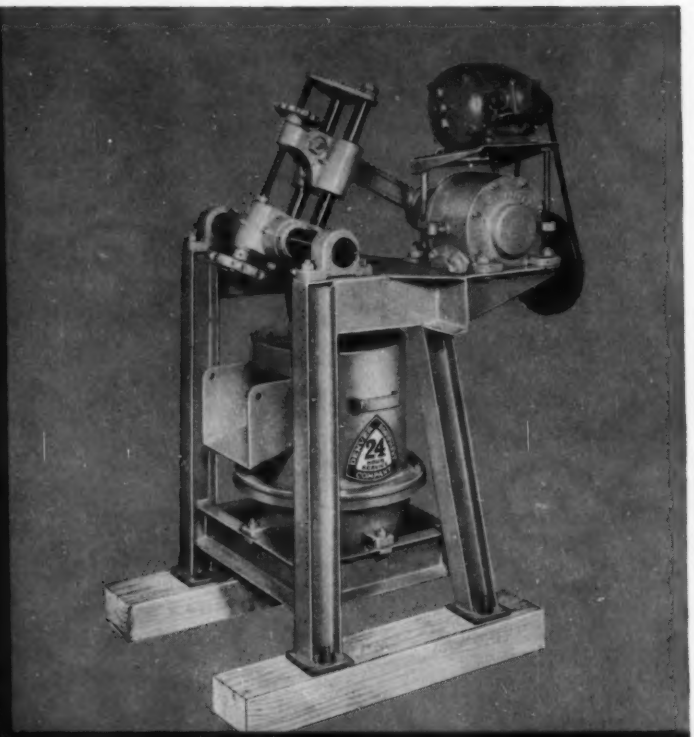
E. P. CADWELL, Bolon 1043,
Of. 6, Lima, Peru

G. B. O'MALLEY
277 Little Collins St., Melbourne C. 1, Australia

Cable Address—Limenitro, New York

AMERICAN CYANAMID COMPANY
MINERAL DRESSING DEPARTMENT
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

NEW 4"
DENVER
ADJUSTABLE
STROKE
DIAPHRAGM PUMP



Improved Design — Increased Capacity!

Space requirements have been reduced for easier installation and maintenance—only 50" high, only 680 lbs. Steel has replaced cast iron to reduce weight.

Lower horsepower is required because anti-friction bearing design practically eliminates friction. Ball bearings are used on crankshaft; Timken bearings on eccentric shaft and needle bearings on pivot points. Power is used to pump instead of overcoming friction.

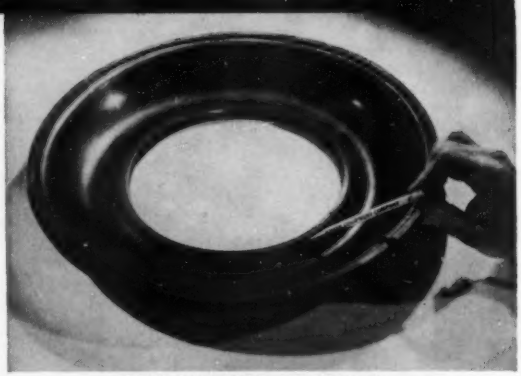
A simplified drive uses standard 1800 rpm motor with V-belt drive to gear reducer.

Improved stroke adjustment tilts backward away from operator. As in all Denver Adjustable Stroke Diaphragm Pumps, adjustment can be made while pump is operating.

This new DECO pump offers you economical, high capacity, low maintenance pumping. Bayonet type or ball valves optional.

For full details, write for Bulletin No. P8-B10

H. W. Heckt, *a graduate mining engineer, has many years' mining and milling experience. His quick understanding of your problems and seasoned ability to recommend practical solutions is available to you. We hope you will consider his recommendations.*



NEW, IMPROVED DIAPHRAGM

- **This new, improved design makes possible a longer stroke and up to 75% higher capacity. Improved design also increases life of diaphragm.**
- **Molded rim evenly distributes tension to entire circumference.**
- **Diaphragm is clamped in place so there are no holes to weaken diaphragm.**
- **Molded rim means faster, simpler replacement. Only 6 bolts to take out to remove yoke-diaphragm unit from pump.**
- **Rubber diaphragm molded with nylon cord has a true catenary curve throughout the stroke, adding greatly to operating life.**

"The firm that makes its friends happier, healthier and wealthier"

DECO ENGINEERED

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

DENVER EQUIPMENT CO.

1400 Seventeenth St. • Denver 17, Colorado

DENVER • NEW YORK • CHICAGO • VANCOUVER • TORONTO

MEXICO, D. F. • LONDON • JOHANNESBURG

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

May 1957

INTERNATIONAL PANORAMA

ADDIS ABABA, ETHIOPIA—Newmont Mining Corporation and associates have closed their prospecting concession in this country without finding any worthwhile mineral deposits. Placer gold was actively sought.

WASHINGTON, D. C.—First uranium concentrate from ore mined and milled east of the Mississippi River will be produced under contract with the United States Atomic Energy Commission by Ramapo Uranium Corporation. Ramapo's production will be from its pilot plant at Warwick, New York.

HURLEY, NEW MEXICO—Kennecott Copper Corporation's Chino Mines Division will spend $6,000,000 to enlarge the power plant, purchase a new shovel, and add additional trucks.

AUCKLAND, NEW ZEALAND—Australian interest has been aroused in the possibility of recovering heavy minerals—limenite, rutile, zircon—from New Zealand ocean beaches.

BUTTE, MONTANA—The Anaconda Company has estimated the following costs in cents per pound for 1956 copper production in the United States: 150,965 tons, 30 cents or higher; 245,848, 29 cents or higher; 359,451, 35 cents and higher. Total production was 1,100,307 tons.

SAN FRANCISCO, CALIFORNIA—The Defense Minerals Exploration Administration has awarded its 1,000 financial assistance contract for mineral exploration. Total cost of all contracts is $47,398,186.

KITWE, FEDERATION OF RHODESIA AND NYASALAND—Rhodesian Selection Trust, Ltd. has awarded a contract to Hunting Geophysics, Ltd. for airborne electromagnetic and radiometric surveys of three areas in the "Copperbelt."

MT. ISA, AUSTRALIA—American Smelting and Refining Company's affiliate, Mount Isa Mines Ltd., is undertaking a major copper exploration program in central Queensland. The firm has authority over 9,020 square miles and plans to use more than 300 men.

ST. LOUIS, MISSOURI—American Zinc, Lead and Smelting Company and Granite City Steel Company have formed a joint venture to explore for ore deposits in Missouri.

GRANTS, NEW MEXICO—Atlas Corporation has acquired a controlling interest in Rio de Oro Uranium Mines, Inc., the first uranium ore producer in Ambrosia Lake. Atlas' subsidiary, Hidden Splendor Mining Company, will operate Rio's mines.

NEW ORLEANS, LOUISIANA—Freeport Sulphur Company has government commitments for purchase of up to 271,000,000 pounds of nickel and 23,800,000 pounds of cobalt by June 30, 1965. To supply this metal, Freeport will build a new mill near Maomao Bay, Cuba and a refinery in Louisiana.

CEBU CITY, PHILIPPINE ISLANDS—Atlas Consolidated Mining and Development Corporation has increased mill capacity to 9,000 daily tons at its Atlas copper mine.

LUANDA, ANGOLA—N. V. Billiton Maatschappij has secured exclusive bauxite prospecting and mining rights in this country under a contract with the Portuguese Overseas Ministry. Bauxite deposits, if found, can be exclusively mined for 70 years.

GRANTS, NEW MEXICO—United Western Minerals Company and Four Corners Exploration Company have made a major high-grade uranium discovery in the southern section of Ambrosia Lake. Early core assays indicated 0.754 percent U_3O_8.

BONNE TERRE, MISSOURI—The St. Joseph Lead Company has developed, by drilling, a large tonnage of iron ore at Pea Ridge at depths between 1,400 and 3,000 feet. Negotiations to mine the deposit have been undertaken with Bethlehem Steel Company.

BANCROFT, ONTARIO—First ore has been milled at the 1,000-ton-per-day mill of Faraday Uranium Mines Limited.

NEW EGYPT, NEW JERSEY—Extensive deposits of ilmenite-bearing sands are being sampled and evaluated near here. Several tracts have been optioned by mining companies.

St. Joe Lead Finds Iron Ore Deposits in Missouri

Another important iron ore district may be in the making with the recent announcement by St. Joseph Lead Company of the discovery of three centers of iron ore deposition about 40 miles northwest of Bonne Terre, Missouri. This part of the state has long been known as a lead belt with such operations as National Lead Company and St. Joseph Lead Company operating near Fredericktown (see map). Iron has also been mined in the area; an M. A. Hanna Company subsidiary, Ozark Ore Company, has been a steady shipper from Iron Mountain for many years.

The new discovery was made as a result of an airborne magnetometer survey in 1951, followed by exploration work. One deposit, known as the Pea Ridge deposit, has been drilled sufficiently to indicate the probability of a very large tonnage of commercial-grade iron ore at a depth of between 1,400 and 3,000 feet below the surface. The two other ore bodies are in the same general area and have been drilled less extensively, but are considered of definite interest. All are located about 20 miles northwest of Potosi in Washington County.

Bethlehem Steel Corporation has proposed joint development of the property. Under the suggested arrangement, St. Joe would have major responsibility for opening the mine and Bethlehem would supply the major financing, their knowledge of iron ore benefication, and a market for the product. The proposal is being considered on the basis of an annual output of 2,000,000 tons.

Also interested in exploring iron ore fields in Missouri is American Zinc, Lead and Smelting Company which has entered into a joint venture with Granite City Steel Company. The agreement calls for development of mining properties for the use of both companies if any commercial discoveries are made. Expenses of exploration and development will be shared equally by the two firms. Operation of any properties developed, however, will be handled by American Zinc.

In June—Full Report On Pacific Coast Borax's Underground Mine

DRAGLINE has proven to be key unit for recovering pillar ore at Standard Uranium's Big Buck mine. The 35-foot-long boom reaches ore under dangerous back with the operator safe under the bolted back alongside drilled pillar.

How Standard Pulls Pillars Safely

Standard Uranium Company mines 96.7 percent of ore body by recovering pillars up to 40 feet high. Dragline salvages ore under dangerous back, uncovers caved ore, and loads Dumptor while operator is in safe position.

By RUSSELL L. WOOD

The Big Buck mine of Standard Uranium Corporation was the first uranium mine in the United States to begin large-scale pillar extraction operations. Since the start of the pillar removal program, some 60,000 tons of ore have been mined from pillars ranging up to 40 feet in height.

The Big Buck mine is located 39 miles southeast of Moab, Utah, in the Big Indian Mining District. Work on the deposit was initiated by Standard Uranium in May 1954, and the first ore was shipped in February 1955. Since that time, over 235,000 tons of uranium ore have been shipped to mills and buying stations in the area.

Mr. Wood is now assistant general manager for Standard Uranium Corporation with headquarters in Moab, Utah. This is the second article he has written for *Mining World*. The previous article in the May 1953 issue, gave the first description of uranium mining operations in the Black Hills of South Dakota.

The Big Buck ore body is located in the lower portion of the Chinle formation, with minor extensions down into the Cutler formation. The ore is relatively hard and well consolidated. The north ore body, from which all pillar ore has come to date, measures about 850 feet in length, with an average width of 250 feet.

The ore body strikes N. 35° W., and dips about 10° southwesterly. The ore thickness averages 14 feet for the entire ore body, and 20 feet in the portion from which pillars have been mined to date. The ore is overlain by several feet of hard, limey sandstone, with incompetent mudstones and shales above this layer. The back stands well with a minimum of roof bolting.

Development of the mine was done by conventional room and pillar methods, with sub-level haulage. The main drifts are run parallel to the long axis of the ore body, and average 20 feet in width, spaced on 40 foot centers. Cross drifts are run on 70-foot centers, and also average 20 feet wide. This leaves pillars 20 by 50 feet, with the long axis parallel to the long axis of the ore body. Approximately 70 percent of the ore was mined in the development phase, leaving 30 percent of the ore in pillars at the start of the pillar removal phase of mining. Normal mining operations were described in the March 1956 issue of MINING WORLD, "Stand-

ard Uranium Mechanizes Big Buck Mine with Gismos."

Early in June 1956, the north ore body had been completely developed. The south ore body was just being put into small-scale production. In order to make the best use of men and equipment, and to maintain production at normal rates, pillar extraction began at this time in the extreme north end of the ore body.

Production at the mine had remained constant at about 400 tons per day, with the pillar mining accounting for varying percentages of this amount. The same men and equipment are used in all sections of the mine, and production from any area is dependent upon the availability of men and equipment, the condition of the cave area, and the day to day grade requirements.

Pillars Mined Separately

The company is fortunate in having a large area to work in during pillar removal. The south ore body is large enough to sustain production by itself at such times as pillar operations have to be suspended due to hazards in the caving area. In addition, the south ore body is much less uniform in grade than the north ore body, and it is very convenient to use the north ore for grade adjustment purposes during the development of the south portion of the mine.

The actual mining methods employed in pillar removal are quite simple and conventional. The usual drill-load-blast-muck cycles have not been greatly altered, nor have any special problems resulted in these operations. Only one special piece of equipment has been employed, a three-quarter-yard Diesel dragline used in mucking.

Drilling is done with a four-machine jumbo using 12-foot feed shells. Pillars are drilled well in advance of blasting, usually from two to six months ahead. This has several obvious advantages. The reduction of noise in the active mining area is of prime importance, in order that the noises of working ground can be heard clearly. Excessive noise also tends to reduce the efficiency of the miners and, in case of an emergency, would tend to confuse the men.

A second advantage of pre-drilling is the reduction of congestion in the extraction area; there are no hoses to drive around, and the jumbo and its prime mover are out of the way. In addition, the drill water and cuttings have long since dried up or run away, and the mucking and haulage equipment do not lose traction on slippery floors.

Pillar Recovery Starts When You Plan Your Mining Method With These Four Basic Fundamentals

1. Mining method must yield high pillar recovery.
2. Dilution of ore must be prevented.
3. Pillar mining costs must be low.
4. Method must be safe for men and equipment.

The main disadvantage of pre-drilling is that sometimes it is difficult or impossible to load holes properly. Minor changes in the extraction program or unexpected rock falls may block holes or place their collars in an unsafe position. In this case the pillar must be redrilled with the jumbo, or occasionally with jackleg machines. However, the number of holes lost due to shifting and slabbing of pillars is negligible. In most cases when a large slab moves, it would be difficult to drill the pillar anyhow, due to the danger of losing the steel and bit when they encountered the cracks.

Pillar Drilling Important

Hole location in pillar drilling is just as important as in a development round. Whenever possible, it is better to drill a cut in each pillar face and blast to this cut, rather than shoot slab holes. Straight slab rounds tend to produce many boulders, and the saving in holes is lost in secondary blasting. It is especially important to keep trim holes parallel, and to have all holes bottoming in the same vertical plane.

When it becomes necessary to use slab rounds, as it is in about 50 percent of the pillar blasting, extra care must be taken in both drilling and blasting to reduce the number of large slabs and boulders. For extremely high pillars, it is common to prime the upper holes one delay ahead of the lower holes in the same vertical row to reduce collar slabs. Usually the rounds are shot with as few delays as possible, except where bad roof conditions make it desirable to reduce the concussion and shock by spreading the explosions over as long a time interval as possible.

Where holes must be loaded in pillars carrying considerable weight, it is important to shoot the holes immediately after loading and wiring. Rounds left a few hours in working ground will either misfire altogether or produce many large slabs due to

CAVED AREA showing typical blocks that have fallen vertically out of back. The pillar at right is 25 feet high, 5 feet wide, and 5 feet long. Note how the top of pillar has tilted down dip to left.

Safety Record at Standard Uranium Corporation's Big Buck Uranium Mine In 1956 and 1957

Year	Man Hours Worked	Wet Tons Mined	Days Lost Time	Severity Rate	Frequency Rate
1955	89,018	96,538	188	2.120	214.00
1956	108,465	113,174	49	0.452	36.88

wires being broken by falling or shifting rocks, or powder trains being broken.

After shooting a round, a supervisor or competent hard-rock miner inspects the blast area. As a rule, the back gives no trouble; slabs or loose rock are seldom encountered. The sides of the pillars may require considerable scaling. New cracks and fractures are watched for in both the back and pillars, and any ground movement is detected by listening for noises. Upon determining that the area is safe for mucking, the shift boss will send in a mucking crew.

If the back and ribs are sound, and the muck pile is free from boulders and slabs, the mucking will be done, with a front-end loader loading into a Koehring Dumptor. This combination of equipment can clean up an area at the rate of 50 to 60 tons per hour. If large numbers of oversize rocks are present, slightly different procedures are used. If possible, the oversize pieces are reduced by secondary blasting before loading. Rocks under two feet in maximum dimension are plastered with 60 percent special gelatin; larger rocks are drilled and shot with 40 percent gelatin powder.

When only occasional boulders are found, they are set aside by the loader until an 8- or 10-ton pile has been sorted. This pile is then loaded and hauled to a secondary blasting area near an ore pass where it will be blasted at the end of the shift.

The Versatile Dragline

If the muck pile has a large number of boulders, or if the area is deemed unsafe for conventional mucking, the dragline, swinging a 48-inch, heavy-duty scraper, is brought into service. This machine is very useful for dragging muckpiles out of dangerous areas. The boom is 35 feet long, and the scraper can be cast an additional five to 15 feet. This leaves the operator well back from the cave. The machine is very effective for sorting muck piles, and a few hours work with the dragline and slusher bucket will drag back and sort a 200-to-300-ton muck pile. This muck pile is much easier to handle with loaders than the scattered piles customarily found after a blast. The dragline and slusher are especially useful for final cleanup, as they can scrape a floor as clean as a man with a shovel.

Occasionally, when there is sufficient height, a regular dragline bucket is used to handle ore. Although this method of mucking is not as fast as a front-end loader, it saves the expense of the loader and operator, and frees them for other work. In the event that waste from the caving area falls on top of a muckpile, the dragline is used to remove this waste and then to pick up the uncovered ore. Because the operator is located at a considerable distance from the danger area, operations can often continue during periods of caving activity.

The management at Standard Uranium feels that the dragline has been a very important piece of equipment in this operation. Without this machine, several thousand tons of ore would have been lost because of the danger of trying to recover it with any other type of equipment. Because of its great versatility, the shift bosses use the dragline for many routine and non-hazardous jobs, such as scaling and loading holes in high pillar areas.

Although the mine has two Gismos available, they are rarely used in the pillar area as they are needed for development mucking in the south ore body. Also, large boulders in the muckpiles are more difficult to handle with a Gismo than with a front-end loader. A D-6 bulldozer is kept in the pillar extraction area for use in bunching up muck piles, handling large rocks, moving waste piles, and maintaining haulage roads.

Roof support has been no problem during pillar extraction at Standard Uranium. No effort is made to provide artificial support in the mining areas once pillar removal has begun. During one period of the development phase, the practice of putting large wooden headboards under roof-bolt plates was common. Subsequent mining operations invariably split and knock out these blocks, leaving the bolt head and plate some four inches below the back, and rendering the bolt completely useless. The presence of dozens of bolts in this condition in some areas, with the back still sound, indicates that the bolts were unneces-

WHAT HAPPENS WHEN BACK CAVES? The idea is, get away fast. The white streak shows how a miner's light looks running in front of camera from cave, left, to safety.

STANDARD URANIUM'S surface plant on the south side of Steen Canyon. Ore bodies are reached through a long adit driven from buildings underneath the ridge to left.

Standard's 10 Rules For Efficient Pillar Recovery

CAVE LINE along pillars from left to right. See how the pillar at left has been drilled for blasting. Roof bolts have held back in place between pillars right up to cave line.

AFTER PILLAR REMOVAL this is caved area. Top of arch is about 50 feet high. Broken rock swell volume is only about 10 per cent. Note how rock has broken away from roof bolts.

1. PILLARS MUST BE VERTICAL: The weight of the back tends to shift down dip only slightly more than in other directions. However, there is an actual movement of the roof mass in a down dip direction proportionate to the length of the stope area open along the dip line. This in turn introduces an overturning force upon the pillars standing next to the cave line. For this reason, it is better to incline the pillars vertically (top up dip) in a flat-dipping ore body, rather than perpendicular to the floorline.

2. WEIGHT ON ADJACENT PILLARS SAME: The caved area tends to maintain an arched or domed roof at all times. This roof dome will change in size and shape immediately upon any changes in the support pattern, such as collapse or removal of a pillar. For all practical purposes, the weight on adjacent pillars will be the same on all sides of the cave area.

3. CAVING FOLLOWS LINE: A cave line, once well established, will resist any attempts to change its direction. If a change in the cave line is necessary, the change must be made gradually, with the expectation that some ore will be lost.

4. KEEP CAVE PARALLEL TO DIP: Because of the slight transfer of weight down dip, it is better to keep the cave line parallel to the dip line wherever possible.

5. MINE TALLEST DOWN DIP PILLARS FIRST: As the extraction progresses, the weight upon the remaining pillars becomes progressively greater, and the problems and complications increase. For this reason, it is better to begin work on the tallest pillars, the farthest down dip.

6. MINE HIGHEST GRADE PILLARS FIRST: In the Big Buck mine, the higher grade pillars are usually weaker than lower grade pillars. When there is a choice between pillars of different grade, it is better to work the higher grade pillar first to concentrate any possible loss in the poorer ore and to preserve the strength of the working area as long as possible.

7. WATCH FOR MASSIVE BLOCKS: The swell factor for broken rock cannot be predicted. As material caves from the back in an unsupported area, it may fall in such massive blocks that the volume increase will be only five or 10 percent. In some of the earlier caving areas at Standard Uranium, there are caves over 100 feet high resulting from the extraction of pillars only 25 feet high. These caves have never worked full, leaving the problem of large rocks breaking loose from the back and sliding down the face of the muck pile.

8. BLASTING DOWN BACK A WASTE OF TIME: Any unsupported ground adjacent to a cave area cannot be depended upon to remain safe. Often large blocks will break off without warning. In the event that a large expanse of back does not cave properly, it is advisable to stay away from the area altogether. Any attempt to break down the back by blasting is usually a waste of time.

9. WHAT IS CRITICAL SIZE?: Every pillar has a certain size, which Standard Uranium calls the critical size, beyond which it should not be reduced unless it is planned to remove the entire pillar immediately. Standard Uranium considers that the critical size has been reached when the shortest side of the pillar is two-thirds of its height. Beyond this point the pillar will act as a slender column and may fail at any time.

10. IT TAKES TIME FOR SAFE BACK: During periods of extensive caving, it may not be possible to work in the pillar area for several hours at a time. Immediately after the complete removal of a pillar, the ground may be unstable for as much as 50 feet in any direction from the new cave.

sary to start with. Recent practice in the south ore body has been to cut down the number of bolts in new development, and to use landing mats with eight-inch square plates or just the plates in many areas.

From the foregoing description, it will be seen that the mechanics of pillar extraction at Standard Uranium appear relatively simple. In order to achieve actual simplicity in operation, it is necessary that initial planning be complete and accurate.

Standard Tries Several Systems

Rock behavior, rather than the wishes of the operator, often dictates methods of pillar recovery. It is impossible to predict the exact behavior of the rock masses under the constantly changing conditions that prevail during pillar extraction. The method of planning the day to day program at Standard Uranium has been to follow certain general rules based upon observations of previous work, and to try to adapt the specific schedule to current conditions.

Standard has tried several different systems of retreat in an attempt to increase the recovery of the pillar ore. In all of these experiments the same retreat line was maintained. Earlier work consisted of reducing the size of all pillars in a row adjacent to the cave until all pillars were at the critical size, and then completely removing the pillar farthest up dip. When this had been accomplished, the next pillar downdip was worked upon.

The next variation tried was to reduce all pillars in the first row to the critical size, and then to begin work on the pillar farthest downdip. These methods were changed to a system whereby only one pillar at a time is worked upon. This system has the advantage of keeping a stronger back in areas that are not being actively worked, but has the disadvantage of reducing the area from which ore can be removed at one time.

The net result of this period of experimentation was to show that none of the methods tried were substantially different from the others as to percent of recovery or mining costs. However it is felt that working on one pillar at a time does decrease the amount of dilution and results in safer working conditions.

The overall percent recovery is of course the biggest single factor in determining the successfulness of pillar extraction. Because of the dissimilarity of conditions between various mining methods, it is difficult to say whether a given percent of extraction is good or bad. The management at Standard considers that their recovery rate has been very good at 96.7 percent of the total ore in place. By concentrating the bulk of the lost ore values into low-grade pillars, the metal recovery rate has been held at 97.8 percent of the total metal content in place. In addition, the ore that has been lost in unrecoverable pillars has been concentrated into two small areas that are presently being developed from the sub-level haulage system. Although the ore recovered from the sub-level will show greater mining costs, it should increase the overall profit.

Dilution in the north ore body pillar recovery operations has been negligible to date. In the rare instances that muck piles have been buried under the cave, a few hours operation with the dragline has recovered the lost ore with a very small dilution factor. The ore in the pillars is sufficiently high grade that a much greater dilution could be permitted if necessary.

Low Cost High Safety

It was believed that pillar mining would be more costly than the development phase had been. With the exception of the first full month of pillar extraction operations, this has not been the case. Overall costs of mining, direct and indirect, averaged $7.03 per ton during 1955. The first six months of 1956 showed an average cost of $6.02 per ton with all of the ore coming from development headings. The second six months of 1956 saw a reduction in costs to $5.89 per wet ton of ore shipped, with about 85 percent of the production coming from pillars.

Although pillar extraction is commonly thought of as being an especially hazardous operation, the results at Standard Uranium have been particularly gratifying from a safety standpoint. The company makes every effort to keep a safe and healthy operation. Extra efforts have been made to provide good ventilation, and the use of generous amounts of auxiliary lighting helps to point out special hazards. The table gives a summary of the safety record at Standard for the years 1955 when 100 percent of production was from development, and for 1956 when about 40 percent of the production was from pillars.

With some 60,000 tons of pillars safely behind them, the staff at Standard feels that they have the situation well in hand. The remaining tonnage in pillars amounts to about 100,000 tons, all in pillars under 12 feet in height. With lower backs and a narrower ore body, a greater recovery factor is anticipated. This will be offset by the higher costs that are to be expected in lower ore, but the overall profit is expected to remain fairly constant.

HEAVY BACK has forced the pillar to break and spall. The left side has broken free of the right side and the weight of back has forced it down into the clay foot wall.

HOW SMALL CAN A PILLAR BE? Not much smaller than the one at left which will soon fail as it is below the critical size. Pillar at right has started to take weight.

THIS GOLD ORE has a combined gold-silver value of only $5.35 per ton. It is treated at a profit by Bald Mountain Mining Company at Trojan, South Dakota.

STRAIGHT CYANIDATION is used on refractory Bald Mountain gold ores. This 350-ton-per-day mill recovers 88 percent of the gold and 55 percent of silver.

It Takes Good Management To Mine $5.35 Gold Ore at Bald Mountain

Today, Bald Mountain Mining Company, 5½ miles west of Lead, South Dakota, is successfully stoping gold ore worth only $5.35 (recoverable value per ton) from several, small, underground mines. Unquestionably this must represent one of the lowest grade operations in the United States—and the only reason Bald Mountain is still in business is because it has whipped production costs into line to meet the fixed price on gold.

To fully appreciate the full magnitude of the conditions under which the company is working, consider these facts. Daily production of 330 tons is obtained from four producing mines, along with a small amount of ore from development headings in two new mines which are being opened. The mines are scattered about the 3,000-acre holdings, and most of them are opened individually. This means separate arrangements are required for servicing and hoisting. The ore deposits are very irregular and exhibit considerable discontinuity, ruling out the application of mechanized mining with high outputs per man shift. Intensive exploration is required to locate ore bodies, and even with careful, selective extraction, mill heads at the 350-ton-capacity CCD cyanide plant will average only $6.24 combined gold-silver.

On the other hand, close study of conditions by supervisors has enabled them to slash mining costs to $2.90 per ton. The milling expense is $1.65 per ton treated. Adding these two together shows that $4.55 is spent for every ton of ore handled, before provision for depletion, depreciation, and taxes. From the indicated gross profit of $0.80 per ton, exploration, development, and capital improvement of plant and equipment must be squeezed.

In the face of this rather gloomy picture, the company, since 1949, has

EMPTY CARS are hoisted from the main mill track to the portal of the Portland incline and then lowered 2,500 feet down the mine incline to main workings.

taken three positive steps in the battle for self preservation. First, a complete pricing study was made of all purchases. The cost of every piece of equipment, down to the smallest nut and bolt, was carefully compared to the performance or use obtained from the item. The same thing was done for expendable supplies. The net result was the application of products better suited for the particular conditions encountered at Bald Mountain.

Second, in 1949 mining methods were improved. Where 132 men were carried on the payroll eight years ago, only 95 are now required to get the job done. The third step consisted of making more effective use of the contract system for paying miners. Practically all work is done on contract now with the exception of certain utility jobs.

Long History

The holdings are located at Trojan, South Dakota, a former booming mining camp. Bald Mountain Mining Company was first formed in 1928 as a reorganization of the old Trojan Mining Company. Adjoining the Bald Mountain holdings is the now-idle Golden Reward property operated for some time by The Anaconda Company. The present mill, which treats the combined output of the several mines operated by Bald Mountain, is an expanded facility of a 100-ton plant built in 1909 by the American Eagle Mining Company. It was subsequently sold to Trojan in 1911 and operated by that company until 1923. The present owners acquired the holdings in 1928. The properties were then idle for a few years, but Bald Mountain resumed activities in 1933 and has operated continuously ever since with the exception of a short period during World War II when L 208 was in effect.

Geology

The ore bodies occur in a series of Paleozoic sediments consisting of quartzites, shales, and dolomites making up the Deadwood formation. Originally deposited in a horizontal position, the sediments have been warped by folding and faulting. Here and there igneous intrusives in the form of dikes and sills have intruded the sediments resulting in local faulting with displacements of a few feet.

Three separate ore horizons in a vertical range of 500 feet are noted at Bald Mountain. Ore deposits are found in favorable host rocks such as sandy dolomites and dolomitic shales. The strategraphic column shows the Deadwood formation at Bald Mountain is resting uncomfortably on Pre-Cambrian schists and separated from the schists by conglomerate. Immediately above the unconformity is a layer of conglomerate and quartzite 10 to 20 feet thick. A narrow band of dolomite 10 to 20 feet thick occupies the position above the quartzite and is separated from a 100-foot-thick alternating zone of dolomitic shales and dolomites by a thick series of mud shales. On top of the alternating shales and dolomites is a 10- to 30-foot layer of dolomite; mud shales above this layer extend to the grass roots.

GENERAL MANAGER P. A. Miller is making money on underground gold ore worth only $5.35 per ton.

Irregular Deposits

Ore-bearing solutions probably percolated up the series through tiny cracks and fissures or fractures. Where these solutions encountered favorable formations, such as the dolomites, they spread out forming replacement deposits. Then, by following fracture systems, the solutions penetrated upward until deposition again took place in favorable host rocks. In the dolomites, the mineralizing solutions often spread out forming bedded deposits as well as fracture and fissure filling. Since dolomitic material is the only favorable host rock, the ore bodies are discontinuous up the series. In addition, the bottom of the ore tends to follow the undulating rolls of the bedding. Because of the irregular system of deposits, no definite method of mining is used. The general trend of the ore bodies is northeast, but changes in direction and dip are common.

In the intermediate zone of ore deposition, the ore bodies vary from 100 to 3,000 feet in length. Widths may range from 6 to 40 feet with a fair average being 8 feet. The height is 20 to 130 feet. In the lower ore zone stope, lengths and widths are similar to the intermediate zone but the height is 10 to 20 feet. In the upper dolomites, the deposits often take on more the appearance of bedded types, but narrow steep dipping bands of ore also are noted and mined at the present time.

Production

The bulk of the ore production today is obtained from the Clinton, Portland, Dakota, and Decorah mines. Two others, the Gold Bug and the Alpha, are being developed. The Alpha started producing shortly after the first of this year.

The Clinton was developed to recover ore from the lower zone; the Portland is on the intermediate zone; and the Dakota on the intermediate and upper horizon. The Clinton mine and the Portland are both opened by 10 to 20 percent, down-dipping adits. The Dakota mine is opened by a 600-foot vertical shaft (now only used to the 100-foot level). The shaft at the

Dakota is for service only since this mine is connected by transfer raises with the haulage level of the Portland mine.

As a rule, development headings in the various mines follow the bottom of the ore whenever possible. In steep dipping ore bodies, shrinkage stoping is the general practice where the gold values extend over 50 feet above the sill. If the ore shoot is less than 50 feet high, open overhand stoping is used to extract the ore. Basic development for each method is the same. First the stope block is undercut. Then a raise or raises are put through to the top of the ore. If this development shows that the ore is less than 50 feet high, the ore is blasted directly to the floor of the drift where it is picked up with mucking machines. In case the ore extends over 50 feet high, a drift pillar is left and chutes installed on 19- to 20-foot centers to draw the ore into mine cars. In flat, bedded deposits, variations of room and pillar methods are used to recover the ore.

Light Ingersoll Rand JR 38A stopers and Thor 380 and 390 airlegs are used throughout the various mines. Gardner Denver and Sullivan mucking machines are used for loading ore from open stopes and in development headings. Drilling steel, ⅞-inch in diameter, is used with 1¾-inch Timken detachable tungsten carbide bits which give footages varying from a low of 125 feet up to 1,000 feet.

Close control of stope limits must be maintained and, in a great many cases, this can only be done with any degree of certainty by sampling. The ore deposits are highly irregular, pinch and swell with little change in outward appearance. Grab samples from mine cars are taken continuously; faces are sampled as often as possible, but not necessarily every round. The samples are assayed in a laboratory adjacent to the mill.

Inclined Haulage

The transfer raises connecting the Dakota mine with the Portland haulage level measure 12 my 16 feet in cross section. All of the ore output from the Dakota is hoisted through the Portland incline. Mancha trammers on the Portland and Clinton haulage levels haul 1½-ton-capacity, gable-bottom cars to a central siding at the bottom of the inclines at the two mines. Since development follows the ore, steep grades often occur and underground hoists are required in some locations to haul loaded cars to the tramming level. Ore cars gathered at the Portland and Clinton underground sidings are hoisted up the incline to the surface.

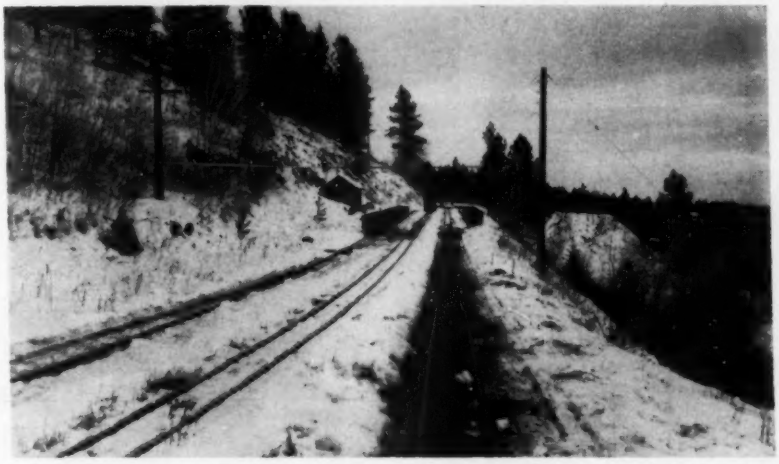
SWITCHING loaded ore cars at portal of the Clinton mine. Portal of the 1,600-foot-long incline is visible at the left. Right track leads to gathering station.

At the Portland mine, eleven of the 1½-ton cars are pulled up the 10 to 15 percent incline by a 125-horsepower Stearns Roger, single-drum, electric hoist. The total length of the Portland incline is about 2,500 feet. Clinton ore is hoisted up a 1,600-foot incline in seven, 1½-ton mine cars by a 75-horsepower, single-drum hoist. At the surface the string of ore cars from the Portland and the Clinton mines is switched and lowered down a surface trackline to a gathering station at the same level with the mill. The surface trackline linking the Portland mine with the surface gathering station is approximately 2,200 feet long and skirts the Clinton portal. In each case a string of loaded cars is hoisted to the surface, switched and lowered to the gathering station. A string of empties is then picked up at the gathering station, hoisted back to the mine portal, and then lowered underground. Two gasoline trammers (one is a 6-ton unit and the other 8 tons) shuttle between the surface gathering station and the mill delivering ore.

For safety purposes, the cars hoisted from the mines are not only coupled with pins, but a continuous safety cable extends from front to rear of the loaded string. If a car coupling breaks, the safety cable will prevent a runaway.

Refractory Ore

Bald Mountain ore is fairly refractory and requires straight cyanidation rather than a combination of amalgamation-cyanidation or gravity concentration. The plant, which was enlarged to 350 tons in the 1920's, is still intact and operating satisfactorily. No attempt has been made to modernize the existing facility because of the tremendous expense which would be involved today. The three receiving bins total 885 tons holding capacity.



GATHERING STATION where loaded ore cars from the Portland and Clinton mines are switched to main mill track. Gasoline engines haul the cars to the mill bins.

Two-stage crushing is employed. A Traylor jaw crusher first breaks the ore to minus-three-inches. The secondary crusher reduces mill feed to minus-¾-inch.

Grinding is carried out in two stages with cyanide-bearing mill solution and a portion of the pregnant solution added to these circuits. The two primary mills are each in closed circuit with Dorr Duplex classifiers. Both primary mills are the overflow type; one is a Stearns Roger mill and the other an Allis Chalmers mill. Overflow from the primary classifiers reports to the secondary grinding circuit consisting of a Denver Engineering Works ball mill and a 10-foot Dorr bowl classifier.

Overflow from the bowl classifier is 65 percent minus-200-mesh and is split between two primary mill thickeners. Approximately 1,900 tons of solution overflows daily from the primary thickeners; 925 tons of this overflow is bled for precipitation. Approximately 60 percent of the recoverable values goes into solution in the grinding circuit.

Screen Analysis Number One Classifier Overflow

Screen Size	*Percent*
Plus 35 mesh	3.0
60	17.2
100	24.4
150	10.8
200	9.4
Minus 200 mesh	35.2

Screen Analysis Number Two Classifier Overflow

Screen Size	*Percent*
Plus 35 mesh	1.8
60	12.0
100	26.8
150	8.8
200	9.0
Minus 200 mesh	41.6

Screen Analysis Bowl Classifier Overflow

Screen Size	*Percent*
Plus 100 mesh	5.1
150	12.5
200	16.7
Minus 200 mesh	65.7

Pulp from the primary thickeners is treated in five agitators and seven secondary thickeners with various combinations of these being possible. The usual practice is to use four agitators in series with the discharge from Number 4 being split between two CCD circuits. Three secondary thickeners, 24 feet in diameter, make up one CCD circuit and four 40-foot-diameter secondary thickeners are in a second CCD circuit. Barren solution from the precipitation circuit is used to wash the pulp. Sands advance through the four-thickener circuit to waste. Overflow from the four-thickener circuit is combined with the overflow from the three-thickener circuit and pumped to the mill solution tank where it again enters the primary grinding circuit.

Merrill-Crowe Unit

A standard Merrill-Crowe precipitation unit, using zinc dust, recovers gold and silver from solution. Solution from the precipitation bag tanks enters the barren solution circuit. Fine gold recovered from the bag tanks goes to a clean-up tank; then is taken to the refinery where the furnaces are fired twice a month.

Total alkalinity amounts to 1.5 pounds of calcium oxide; calcium cyanide solution strength is 1.0 pounds per ton of solution. Four-inch steel balls are added to the primary grinding circuit which produces a relatively coarse product. Two-inch steel balls are added to the regrind mill. Dissolution losses from the mill amount to about $0.08 per ton of solution. The recovery of gold is 88 percent; silver recovery is 52 percent.

Bald Mountain is fighting to maintain its position while maintaining hopes for a better gold price. The company is one of the original six which filed suit against the government claiming that damages were incurred during World War II as the result of War Production Order L208 which shut many gold mines down. A decision by the lower courts was awarded in favor of the companies, but this is subject to review by the Supreme Court. In the event of a favorable decision by the high court, the extent of the damages must still be determined. The fact that Bald Mountain is still operating in the face of spiraling costs is quite remarkable, and a tribute to the management. To many people, Bald Mountain typifies the hopes of all gold operators. To others, it might drive home the present deplorable situation facing the gold miner.

DAKOTA SHAFT is now used as a service shaft only to the 100-foot level. Ore is dropped down transfer raises to the main haulage level of the Portland mine.

CLINTON HOIST house is set well back from the portal of the incline. Total mining and transportation costs for delivering ore to mill are only $2.90 per ton.

In Sweden—

New Building Houses Hoists and Dry Mill

The world's largest hoisting plant and largest dry magnetic iron ore separation mill have recently been placed in operation in northern Sweden. This is the new plant of Luossavaara-Kirunavaara (LKAB) at Kiruna, Sweden, which is shown in the accompanying photograph. The building houses eight Koepe hoists and the eight secondary crushing and magnetic separation sections.

The new Central Plant will be officially inaugurated on October 1, 1957, in connection with the nationalized LKAB's taking over the operation of the Kiruna mine from the Grängesberg parent company. The 11-story building, which measures 375 feet in length, 170 feet in height, and has a width of 96 feet, is one of the major technical facilities created in connection with the gradual conversion of mining from open pit to underground.

The total capacity of the new plant will be 4,600 tons per hour. Each pair of the eight concentrating sections is connected with a mine shaft which bottoms beneath the underground crushing stations. The primary crushers, of Swedish design, have jaw openings of 71 by 55 inches and their capacity is 1,000 tons per hour. From the crushers, the ore drops into pockets holding 3,000 tons, two to each crusher.

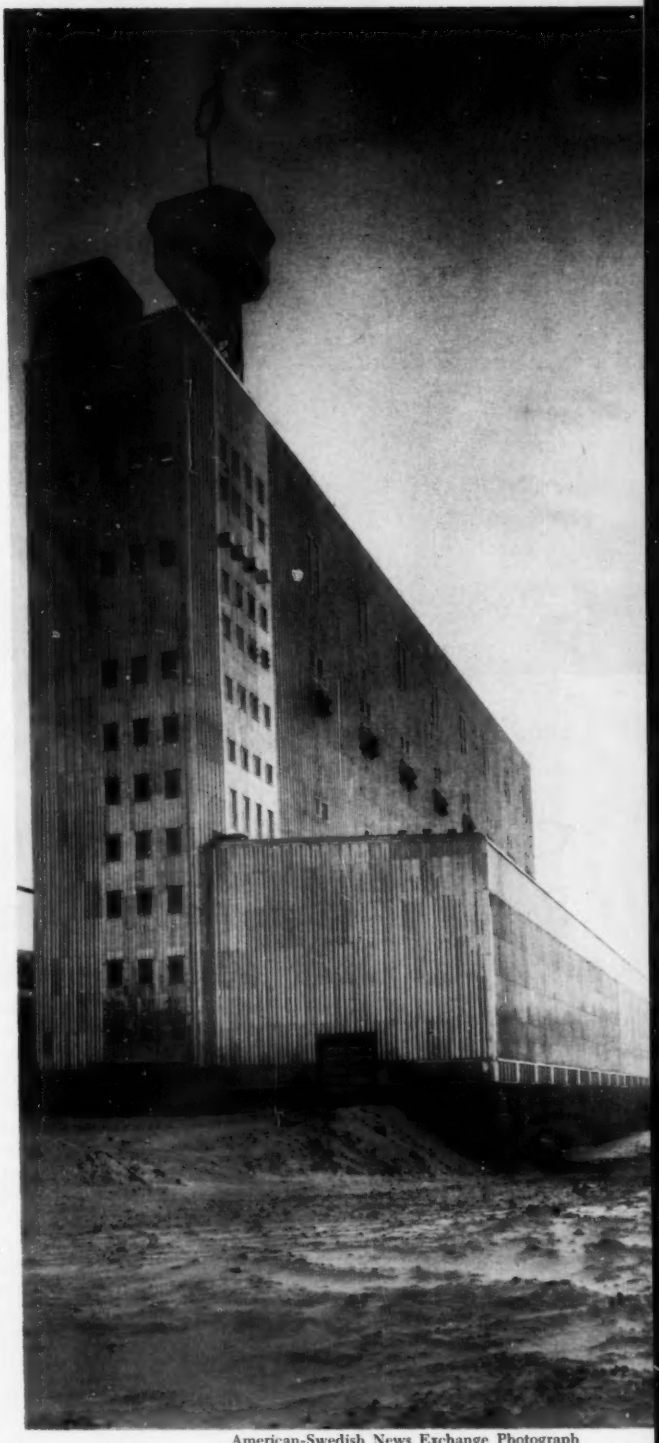
From the underground pockets, the ore passes through a hopper into one of eight skips. Each skip handles a payload of 20 tons, which is hoisted to the top of the mill at a speed of 35 feet per second. The skips are emptied into a system of screens and conveyor belts leading to permanent magnetic cobbers which separate the ore from the rock. Five different grades are produced, ranging from grade A, which has an iron content of 68 percent and a maximum phosphorus content of 0.03 percent, to ore that assays 60 percent iron and more than 0.8 percent phosphorus.

The waste rock, which makes up about 20 percent of the ore mined, is automatically screened off into different sizes, to sell for various uses.

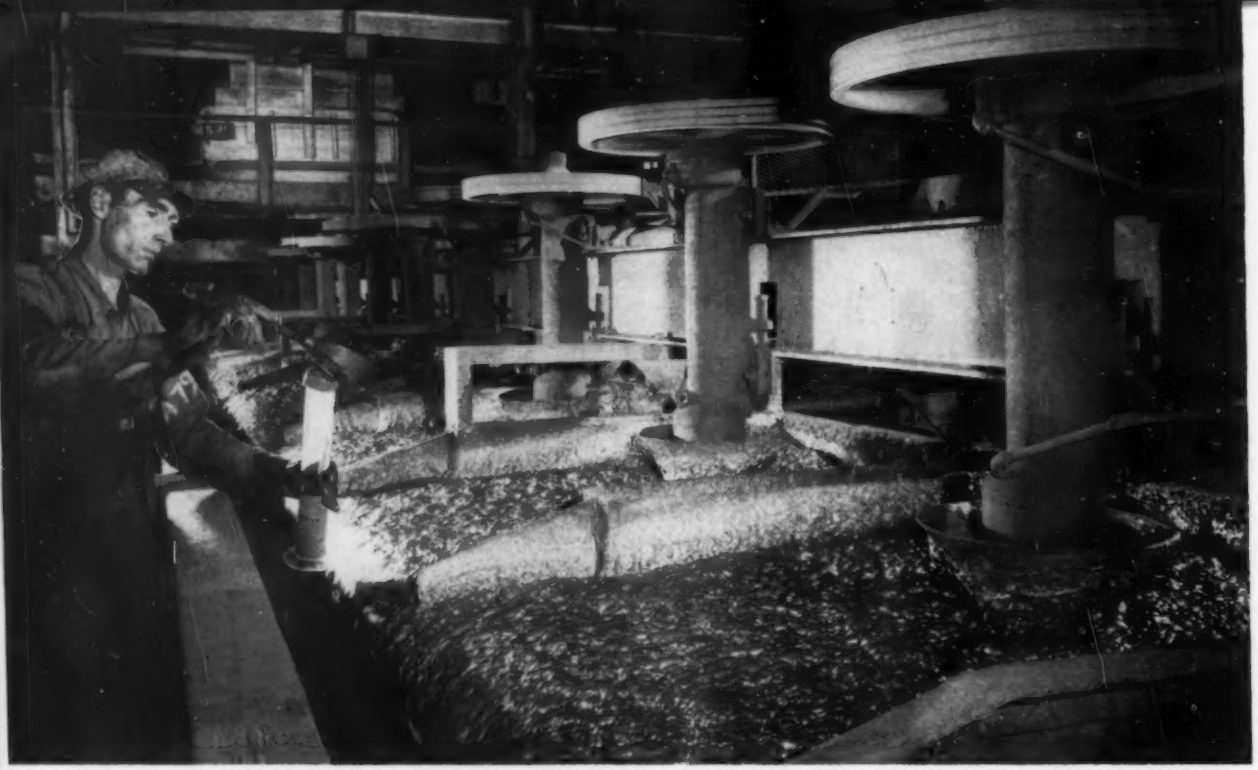
The concentrates drop into 12 underground storage pockets, situated directly below the plant. These pockets, about 300 feet deep and holding some 8,000 tons each, connect through chutes directly with two railroad tunnels. The concentrate is drawn directly into railroad cars. These hold 35 to 42 tons each and are filled in thirty seconds.

Erected by The Swedish Industrial Building Company to the designs of the noted Swedish architect Hakon Ahlberg, the new plant is of special interest also from a building-technical point of view. Very difficult climatic problems had to be mastered, both regarding what materials would be best suited to withstand the extreme cold of the Arctic winter and how to provide effective insulation against the cold.

Winter temperatures at Kiruna frequently range between 20° and 40° F. below zero. The insulation problem has been so neatly solved that the building is heated throughout solely by means of the surplus heat from the electric motors that power the machinery. On the outside of the central concrete core—cast in two stages by means of a sliding mold, having a length of 720 feet—there is a layer of plastic-treated glass wool, four inches thick. Covering this layer there is a face of corrugated aluminum, 1/24th inch thick.



American-Swedish News Exchange Photograph



CONTINUOUS AUTOMATIC CONTROL of reagent additions to differential flotation circuit is goal of metallurgists at Consolidated Mining and Smelting Company of Canada, Ltd's zinc-lead mill at Kimberley, British Columbia. Zinc cleaner froth from No. 24 Denver cells is being collected as a sample. De-zincing step has been incorporated in lead circuit.

COMINCO Seeks Continuous Automatic Reagent Control for Flotation Circuits

At the Sullivan lead-zinc concentrator in Kimberley, British Columbia, one very fundamental piece of research is now underway. The work being done by The Consolidated Mining and Smelting Company of Canada Ltd. may point the way to continuous automatic control of reagent additions to a differential flotation circuit. One key to this goal is continuous measurement of residual xanthate content and pH of the mill pulp and Cominco is developing a method for this. Adapting a controller to the recorder has not yet been tackled but remains a possibility.

A second development is the application of instrumentation in the sink-float circuit to smooth out fluctuations in media density. Add to these ideas a standardized, rapid, 10-minute determination of zinc in mill tailing which mill operators perform, and a de-zincing step to clean lead concentrate, and you have a pitcure of some of the important work taking place in the mill.

Through the years, research has played a very important part in the history of Cominco's operations. The very development of a differential flotation process for the complex lead-zinc-iron ores at the Sullivan mine was a monumental work which established the company firmly as one of the world's leading producers of lead and zinc. Since the mill was first built in 1923 and the following expansion to 11,000 tons daily capacity, research and testing have resulted in a number of improvements in techniques which have been reflected in lowered costs, improved recoveries, or higher efficiency.

Flowsheet

First let's take a brief look at the flowsheet. The mill treats an ore composed of an intimate mixture of galena, marmatite, and pyrrhotite. Coarse crushing is done underground at the mine located about four miles from the mill. Forty per cent plus-1-inch feed is delivered to the mill by trolley locomotives pulling 40, 14-ton capacity cars, and the ore is dumped into a 4,000-live-ton-capacity bin. The ore is first treated by a sink-float process in two parallel circuits where 30 to 35 percent of the feed weight reports as a float or is rejected as waste. About half of this reject is mixed with pyrrhotite concentrate, which forms a bonding cement, and returned to the mine for use in back-filling stopes. The sink is ground in a Hardinge rod mill with the discharge reporting to the primary grinding circuit.

Primary grinding is accomplished in open circuit with the ball mill discharge reporting for a "coarse lead float" in Denver cells. A portion of this coarse lead concentrate is used as the make-up medium in the sink-float circuit. Tailing from the coarse lead float goes by gravity to the secondary fine grinding circuit which is followed by a tertiary grinding installation. Both of these phases operate in closed circuit with classifiers. Overflow from the secondary classifiers reports to tertiary classifiers and the tertiary classifier overflow enters lead rougher flotation machines.

Lead rougher concentrate is cleaned, recleaned, and then pumped

to the de-zincing circuit. Tailing from the lead roughers flows to the zinc circuit, and zinc rougher concentrate is cleaned in three stages. Zinc rougher tailing goes to a tin circuit where the pulp is de-slimed, iron sulphides removed by flotation, and a cassiterite concentrate is produced by gravity methods.

Xanthate and pH

At the Sullivan mill a very close correlation has been found to exist between the pH and xanthate concentration on one hand and the metallurgical results on the other hand. These findings were published in a very good paper by C. H. Bushell and M. Malnarich of the Cominco staff (*Mining Engineering*, July 1956). First a method was devised to analyze mill pulps for residual xanthate concentration, and a series of tests was devised to determine the relationships of various flotation reagents to the metallurgy. Now development of a continuous method for recording xanthate concentration and pH is underway. The ultimate goal is a recorder-controller which will automatically meter reagents to the circuit to compensate for changing ore characteristics.

The full importance of the work on reagent additions can't be emphasized too highly. At this mill, as at all other mills, control of daily metallurgy quite largely follows visual or analytical determination of operating results. Too often some rule of thumb motivates a flotation operator's judgment in making adjustments of feed rates, water introduced, reagent additions, and the many other variables entering into flotation. Where one mill man may pour on the xanthate and cut the lime, another will do exactly opposite, and each will claim he is getting better results. Flotation is still an art and not a science.

Continuous Measurement

These basic premises are involved in the program on reagent control at Cominco:

(1) The amount of collector absorbing on a mineral surface is a function of the collector concentration in solution.

(2) An optimum collector concentration exists whereby the selectivity for a given mineral is greatest. Above this concentration too much of the unwanted mineral is coated, while below this concentration not enough of the wanted mineral will float.

(3) Practically all reagents except some frothers affect the ability

XANTHATE MEASUREMENT and pH control are installed at the tail end of this zinc roughing circuit. The machines are 16-cell Minerals Separation units. Mill results are compared with precisely measured reagent concentration.

PRIMARY GRINDING of sink-float concentrate is done in this 11-foot 5-inch by 12-foot Hardinge rod mill. Rod mill overflow is reground in open circuit ball mill with overflow getting a "course lead float" in Denver machines.

HUNTINGTON-HEBERLEIN SINK-FLOAT SEPARATORS make a gravity concentrate for flotation feed at mill. There are two 11-by 11-foot units which reject 30 to 35 percent of ore mined ahead of flotation. Reject is returned to mine for back fill.

of the collector to absorb on a mineral surface either by competing for available sites or by solution effect.

It is with these factors in mind that the Cominco staff is making a start on continuous measurement of xanthate and pH since their relationship seems to exert coisiderable influence on flotation results. For this work a Beckman continuous measuring spectrophotometer has been purchased and will be employed along with a recording pH meter. These instruments will be placed in operation at the tail end of the zinc circuit so that mill results can be compared to precisely measured reagent concentrations. Even if automatic control proves impossible or impractical, or if this isn't the proper way to go about mill control, the data gathered should be invaluable. Not enough is known of the effect of the variables in flotation and some interesting observations will be possible.

So far as is known, this is the first attempt to instrument an ore beneficiation plant in this manner, and it can certainly be said that Cominco is standing on a frontier.

Sampling for Clear Solution

The apparatus to measure the reagent quantities will consist of a sampling device, the Beckman spectrophotometer, and a pH meter. One mechanical problem which has been encountered is how to obtain a proper sample for analysis in the recording instruments. The spectrophotometer, which will record xanthate concentration, requires a crystal clear solution which is free from all traces of cloudiness.

Thus a double filtration technique, using filter cloth and a ceramic filter plate, is employed to remove all solids. Originally, a vertical airlift, made of 2-inch pipe and with the lower end inserted in the zinc tailing race, was used to obtain the pulp sample. One section of the airlift was joined by an 18-inch section of ordinary canvas filter cloth, and the discharge end of the airlift allowed excess pulp to drain back to the tailing launder. A certain portion of the mill solution, however, weeped through the filter cloth sock to a catch basin around the outside of the airlift. Later it proved more practical to replace the airlift with a pump while using the same basic arrangement for filtering coarse solids from the solution sample.

From the catch basin the partially clarified solution drains through a circuit containing (1) a ceramic filter; (2) a totally enclosed chamber housing pH electrodes; and (3) finally flows to the discharge back at the tailing race.

Buffer Solution for Dithizone Assay for Zinc Tailing used at Sullivan Concentrator of Cominco. Each 1,000 cubic centimeters of solution contains:

Sodium acetate	136 grams
Glacial acetic acid	57 cubic centimeters
Ammonium citrate	5 grams
Sodium thiosulphate	50 grams

Dilute to 1,000 cubic centimeters with water

The chamber housing the ceramic filter is at the lowest possible elevation in this circuit and the pipe at the top of the chamber leads up to the electrode chamber. The discharge end, leading from the electrode chamber, is at an elevation as nearly equal to the catch basin as to just overcome the pipe friction. The necessary pressure for the ceramic filter is dependent on the hydraulic head between the discharge end at the tailing race and the filter chamber. The filtrate passing the ceramic plates is conducted to the spectrophotometer.

Enough solution is required to pass the ceramic filter to provide 150-cubic centimeters of crystal clear solution for measurement in the spectrophotometer. The measurement of pH doesn't require the removal of all solids so excess solution by-passing the ceramic filter is of sufficient clarity for this purpose.

This experimental apparatus has been tried and will work. An early problem in hydraulics existed, which amounted to design of equipment that would provide the required head to force solution through the filter cloth on the airleg and then through the ceramic filter in the required volume. This detail has now been solved.

Sink-Float Instrumentation

Another new idea is being tried in the sink-float section where a galena suspension is employed as the media in the two separatory vessels. Optimum specific gravity for the ore now being treated is 2.95. The media, however, is diluted by water from washing and drainage screens handling the sink-float products, and by varying amounts of moisture introduced with the feed to the circuit. Make-up media from the "coarse lead cells" is delivered to a 20- by 10-foot stock tank after first being cleaned, thickened, and de-watered. Before the installation of instruments, the quantity of make-up media admitted to the circuit was adjusted manually by an operator after half hourly checks of the density. Every 30 minutes a mill operator would manually take a sample from the density pocket installed on each separator and measure the specific gravity.

Near the first of the year a continuous recorder was installed to chart a record of media density, and to aid operators in maintaining the proper density. Essentially the equipment is nothing more than a bubbler density tube indicator which is familiar to all instrument men. This consists of two vertical tubes, a high leg and a low leg, which are inserted into the suspension in the sink-float separators. Each leg is interconnected by a pipe through which air is introduced under pressure. Equalizing valves on the two legs control the flow of air so that equal volumes are admitted to the two legs. The high and the low tubes are connected at the top through a manometer which is calibrated to indicate media density.

Less Density Variation

At the Sullivan plant, a certain amount of plugging at the end of the legs inserted in the separators has been experienced. Therefore, they have made a slight innovation with the standard bubbler tube, and are now using a water purge rather than air to eliminate this trouble.

The manometer scale indicates a density range from 2.85 to 3.05 units and is coupled to a recording unit which inks a permanent record. The scale can readily be read to 0.01 units. The density indicator has been in operation for several months as a recorder only. The next step is to add a controller to compensate for density changes. An automatic valve is now on order to convert the recorder to an automatic, recording-controller.

In the time that the instruments have been used as recorders, the variations in the media density have been reduced considerably. Using manual control to add make-up media, mill operators in the sink-float section can practically draw a straight line on the graphs. Maximum variation in the density of the media is now less than 0.03 units. The unit reacts quite quickly to changes in density, and as a result closer control of separating conditions in the sink-float plant is now possible. Variations in the amount of moisture contained in the feed to the point will soon register in changing density, and compensations in the

amount of make-up media can be adjusted right away.

Rapid Analysis

One method of control at the concentrator which has proved quite successful is the adoption of the dithizone method for determination of zinc in mill tailing. This analysis is run hourly by flotation operators and the result is known within 10 to 15 minutes after the sample is prepared. The method has been found to be accurate within 10 percent of the true analysis which is close enough for routine checks of tailing. It goes without saying that the method would produce erratic results on a high-grade concentrate, however. The operating department of the mill knows the tailing assay within the hour and can thereby judge mill performance. This practice has been in use for over a year.

The dithizone method is a colorimetric determination which consists of measuring out a 0.5 gram sample into a beaker, adding nitric acid, and taking to dryness. The residue is taken up with hydrochloric acid and diluted to 500 cubic centimeters with water. A 1 cubic centimeter sample of the diluted solution is taken by pipette and introduced to a test tube to which 10 cubic centimeters of the buffer solution indicated in the table is added. Then 10 cubic centimeters of a 0.01 percent dithizone-carbon tetrachloride solution is added and the mixture in the test tube is shaken vigorously. Color will develop in the dithizone carbon tetrachloride layer, and this is compared with Hellige standard indicators in a Hellige comparator.

Great Care Required

The assay method is very sensitive and requires great care to prevent contamination. The buffer solution must be purified after it is made up to remove any interfering metals. The buffer solution contains sodium acetate and glacial acetic acid normally. To simplify reagent additions during the analysis for Sullivan ores, ammonium citrate and sodium thiosulphate are also made up with the buffer. Ammonium citrate removes any discoloration which might result in the dithizone-carbon tetrachloride layer due to the high iron content of the ore. The function of sodium thiosulphate is to eliminate interference caused by lead. Reagent additions are made according to proper proportions so that colorimetric comparisons indicate the percentage of zinc in tailing directly. The Hellige color standards, though not quite true in color, have produced very good results.

De-Zincing

Over the years there has been a gradual change in the lead-zinc ratio of the Sullivan ore toward a lower proportion of zinc. This was accompanied by an increase in the floatability of zinc with the result that more and more zinc was reporting to the lead concentrate. It became increasingly difficult to depress the zinc in the lead cleaner cells even after more zinc depressants were added to the circuit. Moreover the addition of starvation quantities of lead collector in the cleaner cells failed to improve this condition.

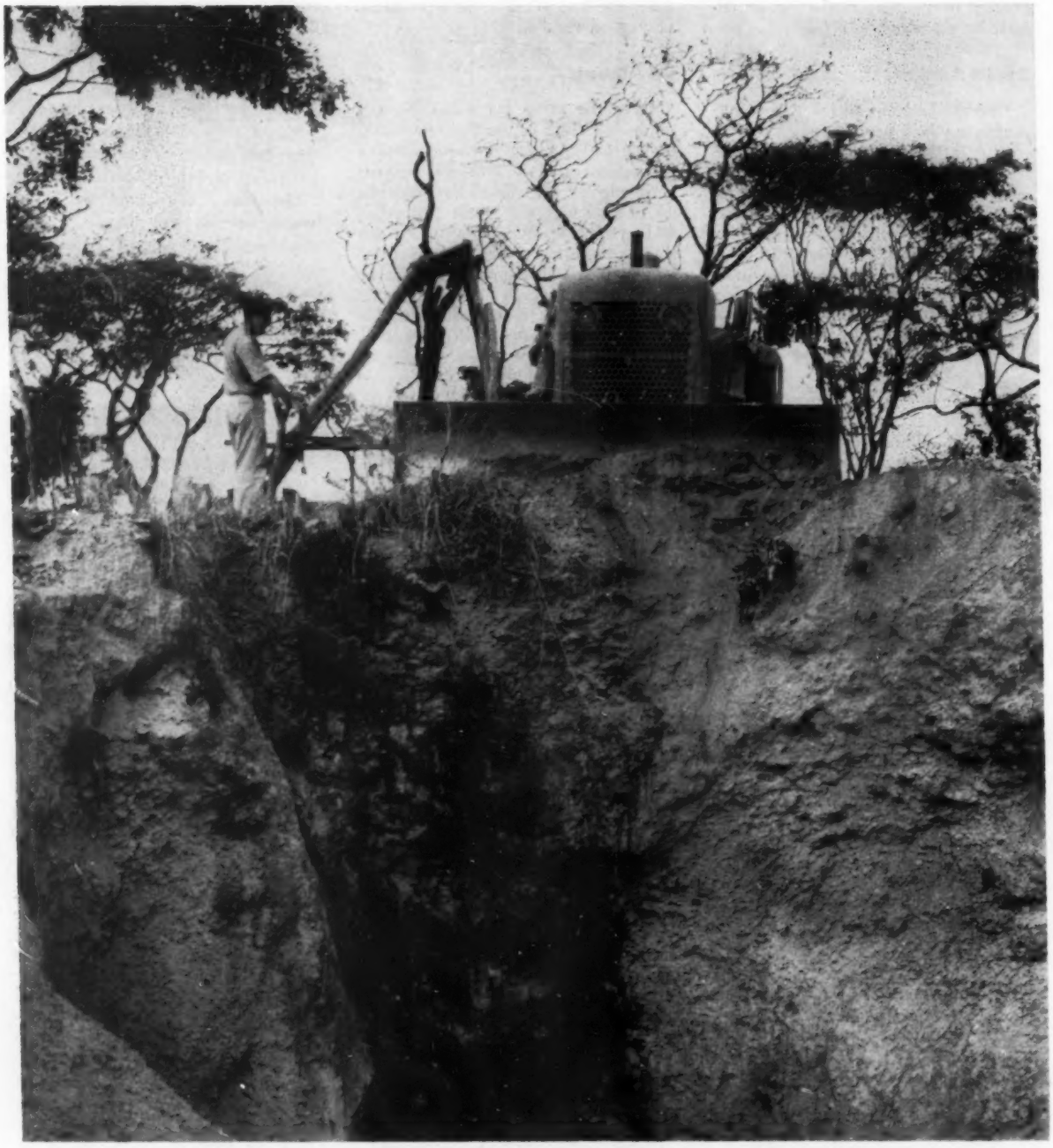
From the standpoint of smelting economics (Cominco is a fully integrated company), the increasing zinc content of the lead concentrate was an undesirable situation. Following laboratory and mill test results which had been conducted back in the 1940's, therefore, a de-zincing step was included in the flowsheet. This process is just the reversal of a normal cleaning operation. Recleaned lead concentrate is conditioned to depress the lead and the 80 percent of zinc contaminant is removed by flotation. The tailing from this treatment section is the final lead concentrate. The low-grade zinc concentrate is blended with cleaned zinc concentrates from the zinc re-recleaner cells to make a final zinc concentrate. The overall result is that the grade of the lead concentrate is increased by 10 percentage units while there is a seven unit reduction of zinc in this concentrate. Lead contained in the zinc concentrate increased about three to four units. In the de-zincing circuit, approximately 80 percent of the lead is depressed and reports to the final concentrate.

Recleaned lead concentrate is pumped to a conditioner where sodium bichromate and copper sulphate are added to depress the lead and activate the zinc respectively. The temperature of the circuit is maintained at 40° Centigrade which also aids in lead depression. The conditioned pulp enters a 12-cell, Number 30, Denver flotation machine. The first two cells are used as cleaners, the next four as roughers, and a middling product is taken from the final six cells. Lime is added to the feed to the flotation machine. The alkalinity of the circuit is maintained at 1.5 pounds of lime per ton of solution and the amount of lime required is determined by titration of the feed. Total conditioning time varies from one to two hours.

SULLIVAN MILL where research has played a most important role in development of the flotation process. Research and testing continue to play an important part in COMINCO's efforts to cut costs and increase mineral recovery.

Of course the ideal condition to solve the zinc problem in the lead concentrates is to find a combination of zinc depressants which would selectively slow the floatability of this mineral in the lead cleaners. Laboratory investigation along this line is being done, and it is possible that something will be developed.

This article described just a few of the ideas or refinements made at the Sullivan mill in very recent years. Many other developments have been carried out in the past and several other projects are now under investigation. Forward thinking management certainly has placed Cominco among the world's great metal mining firms.



BULLDOZER EXPOSES typical manganese ore body at Bahati mine. Manager F. H. G. Norse stands at vein's apex.

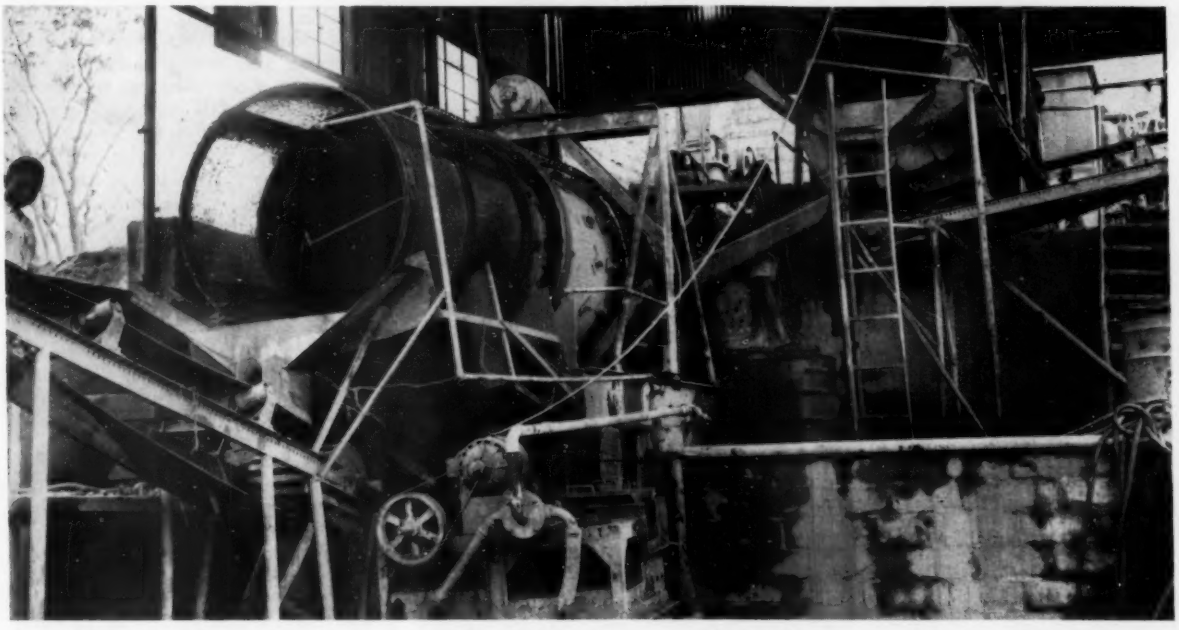
Rhodesian Firm Opens Mangabelt

The first large-scale manganese mine in the northeastern sector of Northern Rhodesia is under development by the Rhodesian Vanadium Corporation, a subsidiary of the Vanadium Corporation of America. Production is currently at a rate of about 24,000 tons per year.

The 200-square-mile concession known as the Bahati mine is 15 miles from Fort Rosebery in the Northern Province. It appears to be of such promise that the local name for it has become "The Mangabelt."

Bahati was discovered in 1931 by J. B. Taylor, a geologist for Loangwa Concessions (N.R.) Ltd., but the claims were allowed to lapse. A. S.

MINING IS BY OPEN PIT which permits development of ore bodies and adjoining "rubble beds" to a depth of 50 feet.



ORE IS WASHED and sized in two trommiels with concentrate conveyed to stockpile at top right. Jig in foreground.

District For Large-Scale Mining

Kerr staked claims there in 1952 and carried out sufficient work on the ore body to obtain samples which showed the deposit to be high-grade manganese ore.

Mr. Kerr prospected the claims until 1953 when Weedon's Minerals Ltd. heard of them and eventually acquired the concession. Rhodesian Vanadium optioned the property from Weedon and then purchased it in October 1955. It is only since then that large-scale development has taken place.

The workable ore bodies average about 1,200 feet in length, three feet in width, and up to 150 feet in depth. They occur on or close to the surface in at least 22 places in the concession

J. D. ROBINSON examines largest solid piece of manganese ore removed at Bahati.

NATIVES CAREFULLY PICK out every piece of manganese ore from trommel tailing.

SERIES OF DAMS impound slimes permitting clear overflow to local streams.

which is by no means fully prospected yet.

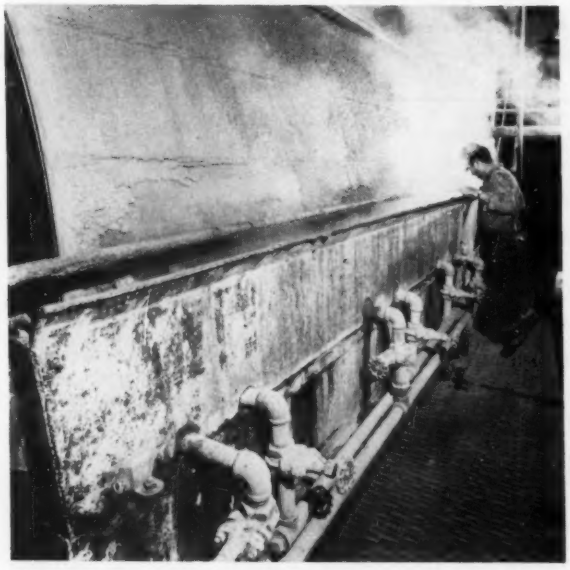
In addition to the massive ore bodies, "rubble beds" containing 10 percent or more of ore extend 50 feet on either side of the main body. These "rubble beds" and the ore body are developed by open-pit methods to a depth of 50 feet. So far only prospect shafts have been sunk and it has not yet been decided whether underground mining will be undertaken since the soft friable ore will necessitate costly mining methods.

A labor force of 400 Natives from the surrounding countryside carry out the operations which are mostly by hand. The manager and a European staff of six direct the work.

Ore is mined in the open pit by bulldozer and front-end loaders. It is moved to the washing plant by truck. The ore is hand sorted and high grade is separated. The finer high-grade ore is dumped into a bin and conveyed to the first wash trommel. Simultaneously, the low-grade and coarse ore drop to a jaw crusher. Crusher undersize joins the first trommel feed. Washed coarse high-grade from the first trommel is conveyed out of the building and sent to stockpile. The undersize from the first trommel is re-washed in the second trommel. Fines from the second trommel are treated in a two-compartment mechanical jig to produce concentrate and tailing. The coarse material from the second trommel drops onto a sorting belt where natives carefully pick out any pieces of ore.

Initially, a washing plant was installed which operated at a rate of about 1,500 tons per month. A new plant has now increased this to between 2,000 and 2,500 tons per month. The overall manganese production in Northern Rhodesia increased from 17,331 tons in 1955 to 39,438 tons in 1956; much of this increase is attributed to the Bahati mine and mill.

The biggest problem for company officials now is transportation. The ore is transported from the mine by 10-ton Diesel trucks and trailers. Present bottleneck is the Chembe ferry which has to make two trips to take a truck and its trailer across the Luapula River. From there the ore is trucked 150 miles to Mufulira in the center of the Copperbelt. It is then sent by rail to Beira where it is finally shipped to the United States. The concentrates are destined for Vanadium Corporation of America's plants where manganese requirements have steadily risen in the past few years because of the addition of ferromanganese, silicomanganese, and manganese foundry alloys to the company's "Vancoram" products.



FILTERING capacity was quadrupled by Separan at this mill.

THICKENING capacity was increased three-fold at this mill.

Why Separan 2610 Cuts Milling Costs At Colorado Plateau Uranium Mills

A recent metallurgical survey of Colorado Plateau uranium mills has indicated that a synthetic organic flocculant has been an important factor in lowering mill construction costs, increasing throughput at existing mills, raising recovery, and lowering operating costs.

Since the ores being mined on the Plateau contain an average of only 0.23 percent uranium, the problem of achieving the most complete recovery of uranium possible has been a real challenge to the industry.

Similarly, with so many different kinds of ores being treated for their uranium content, one major economic factor in the industry has been the question of discovering technically feasible processes which will uniformly extract the maximum of uranium and produce these values in a readily marketable form for the AEC.

Separan 2610, the new high-speed flocculating agent of The Dow Chemical Company, was developed several years ago after an extensive period of research. The chemical is a high-molecular-weight acrylamide-type polymer. It has made counter-current decantation, one of the main recovery processes, feasible by greatly decreasing production costs. It has been an indispensable factor in the efficient operation of carbonate leach circuits. Moreover, it has permitted the raw leaching of sandstone ores; roasting had been a necessary preliminary step in treating these ores. Finally, it has, in the words of a Colorado metallurgist, "changed people's thinking on the construction of mills, by eliminating bottlenecks in mill expansion."

Another big mill in southwest Colorado has found effective use for Separan 2610 in its precipitation plant, where it controls green sludge in large thickeners. The capacity of these thickeners has increased three-fold. Big 60-foot thickeners high above this mill's precipitation plant use it to give its counter current decantation circuit a more uniformly clear pregnant liquor overflow. Higher still in this plant's layout is a final thickening tank which utilizes this flocculant to remove all solids from solution prior to dumping the solids in a tailings pile.

One of the mill superintendents at this plant says, "Separation is one of the problems and bottlenecks in the early days of every plant. On our secondary acid leach circuit we had tried many products without success. When we first tried Separan before we knew exactly how much to use it was so good that it clogged our thickeners and stuck the rakes, but we've now worked it out so that the slime bed is six to 10 feet below the surface in our 14-foot-deep thickeners. Before we tried that flocculant, it was only one to two feet from the top and often it was running over. We had to shut down when the slime ran over, and that cost money." He went on to say that in the primary acid leach circuit, its use has increased tonnage by 20 to 25 percent.

Still another big mill in New Mexico has quadrupled the capacity of its filters on current ores by using the flocculant, while another circuit in the mill has tripled capacity. Commenting on the old days—in this mill's case that means 1954—the mill superintendent said, "We were stymied on our limestone ores. They were difficult to filter. But when Separan came along and we tested it thoroughly in our labs and later installed it in the carbonate leach circuit, we immediately doubled our filtration rates." He cautioned, however, that any filter aid has to be applied correctly, and that when the bugs were ironed out "we were able to make a real contribution to the AEC program. Most filter aids build up organics in a system and foul it," he said. "Separan gives no problem on this point. In fact, our sandstone ores cannot be filtered effectively without it."

In carbonate leach filtration from 0.1 to 0.4 pounds of Separan 2610 per ton of processed material has yielded four-fold filtration rates, while in acid leach filtration from 0.05 to 0.2 pound of the flocculant per ton is common.

Although the uranium milling industry has made effective use of Separan 2610, other mineral industries—copper, lead, zinc, manganese, soda ash, titanium, and others—have achieved similar results with the flocculant.

Mining Highlights In 1956 in Venezuela, Kenya, French Guinea, and French West Africa

FRENCH GUINEA

Efforts were being made in French Guinea in 1956 to expand mining activity. The Guinea Mining Bureau (Bureau Minier Goyanais) had a program underway to increase gold production. In 1956, 181 kilograms were produced compared with 300 in 1955. The Bureau during the year studied plans to start bauxite mining at the recently discovered Kaw deposits. Columbite-tantalite output declined to 6,800 kilograms during the year, down from 10,000 in 1955.

FRENCH WEST AFRICA

Increased iron ore and diamond production were the highlights in mining in French West Africa in 1956. The Mining Company of Conakry mined 1,093,000 metric tons which yielded 846,925 tons of shipping ore and concentrate. Shipments to Poland, West Germany, and Belgium totaled 822,413 tons. Exports in 1955 were 674,949 tons.

Diamond production rose from 318,000 metric carats to 390,000. During the last part of the year, illegal mining and smuggling reached serious proportions.

Bauxite output from the Isle of Los dropped slightly to 452,000 tons, compared to 480,000 in 1955. Bauxite mining in the inland part of Guinee was decided upon during the year.

Mining of beach sands continued in Senegal during the year. Exports were 20,000 tons of ilmenite concentrate, 580 tons of rutile, and 700 tons of zircon. Production of zircon totalled 1,150 tons.

Metallurgical pilot plant studies continued during the year on the copper ore from the Akjoujt deposit in Mauritania. This test work yielded concentrate containing 360 tons of copper and eight kilograms of gold. The cassiterite mines at Air continued to produce during the year. Output was 80 tons.

KENYA

Preliminary figures from the Keyna Government Mines Department show a considerable increase in mineral output value for 1956.

Largest single producer continued to be the Magadi Soda Company whose output of soda ash increased by 21,582 tons to a total value of £1,590,876.

The new mill at Macalder-Nyanza mine, near Lake Victoria, was officially opened in April and total production in 1956 amounted to 859 tons of copper, worth nearly £189,000. Colonial Development Corporation, owners of this mine, are using the newest metallurgical processes in the mill, including the Fluo-Solid reactor process. Other production from this mine included 3,028 ounces of gold and 52,698 ounces of silver.

At the Mrima Hill columbium-rare earth deposit near Mombasa, under special prospecting license to Anglo-American Corporation of South Africa since October 1955, the sampling and exploration program was completed. The economics of the deposit are under investigation in the light of sampling results.

At Murka, New Consolidated Goldfields took over the kyanite property of Kenya Kyanite Ltd. and reorganization of the mine and mill continued through the year. No mineral was produced.

Mineral Production in Kenya and Value in Pounds in 1955 and 1956

Commodity	1955 Quantity	1955 Value	1956 Quantity	1956 Value
Diatomite[2]	2,950	$3,119	4,837	95,730
Gold[1]	9,528	119,749	13,842	172,545
Kyanite[2]	2,706	75,688	—	—
Gypsum[2]	851	5,105	1,908	13,830
Salt[2]	25,376	200,859	21,885	186,223
Soda ash[2]	124,744	1,308,250	146,326	1,590,876
Asbestos[2]	136	1,632	152	3,932
Graphite[2]	216	10,800	553	22,112

1. Fine ounces. 2. Tons.

VENEZUELA

The mining industry in Venezuela in 1956 produced the largest tonnage of ores and minerals in history. Iron ore, gold, and asbestos output reached record highs.

Further expansion in iron ore output is planned by both the Orinoco Mining Company (United States Steel) and Iron Mines of Venezuela (Bethlehem Steel), as shown in accompanying table. By 1958 Orinoco plans to reach maximum capacity of its existing mining, rail hauling, and shipping facilities.

There was great interest in locating new claims; however, the government is reluctant to give new mining rights until the actual petroleum policy of new concessions is over. That is to say, the government has realized that it is better to firmly establish new oil industries throughout the country before the iron industries should expand. It is possible that any new step will be to establish a few small mining operations to supply local consumption. The government worked steadily on the steel mill near the Orinoco Mines (Puerto Ordaz) at a cost of $150,000,000. The plant will require 200,000 metric tons of high-grade ore per year. It is expected that this plant will start operation in 1958, at the same time that the Caroni Electric Project will commence generation with 200,000-kw capacity in the first stage, ultimately reaching 300,000 kw.

Practically all the production of gold in Venezuela in 1956 came from the Callao District. This mine resumed production under the government auspices in 1954 after reaching a crisis during which the production was practically negligible. The plant was reconditioned, new workings started, and production reached a new high. It was reported that the management made great efforts in finding unknown lodes, thus increasing the reserves. The production of gold from alluvial districts was 112,453 grams.

Gold production from the El Callao mine in grams by years has been 1,909,-067 in 1949; 1,071,886 in 1950; 88,974, 1951; 143,117, 1952; 850,000, 1953; 1,-744,088, 1954; 1,900,000, 1955; and 2,-171,820 in 1956.

The diamond production declined during the year. The total combined output of two mining districts was of 93,883 carats. No new discoveries have been made public.

Great activity was shown in the asbestos district of Tinaquillo. The plant and mine were completely reconditioned, with a consequent increase in production. It is expected that the studies in progress will show a substantial increase of reserves.

The phosphate deposits of Riecito, in the state of Falcon, were mined for the first time. Production was 30,200 metric tons for the year 1956.

The search for bauxite was intensified by the government and it has been said that promising deposits have been located in the Mesa de Nuria, State Bolivar.

Metal and Mineral Production in Venezuela 1950 Through 1956

Commodity	1950	1951	1952	1953	1954	1955	1956
Iron ore[1]	198,953	1,269,611	1,969,802	2,296,402	5,420,597	8,300,000	11,104,783
Gold[2]	1,071,888	88,974	143,117	850,000	1,744,088	1,900,000	2,171,820
Diamonds[3]	60,389	63,226	92,290	84,789	96,982	140,000	93,833
Asbestos[4]	190,150	259,695	383,470	40,387	44,042	150,000	528,000

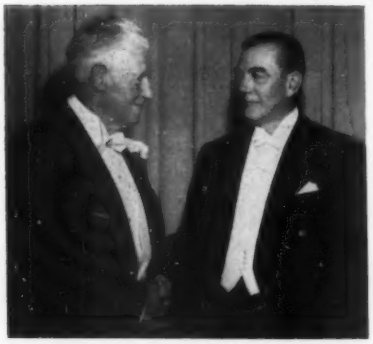
1. Metric tons. 2. Grams. 3. Carats. 4. Kilograms.

Production of Iron Ore in Metric Tons by Companies in Venezuela from 1950 through 1956 and Projected Production through 1958

Year	Iron Mines of Venezuela	Orinoco Mining Company	Total
1950	198,953	—	198,953
1951	1,269,611	—	1,269,611
1952	1,969,802	—	1,969,802
1953	2,296,402	—	2,296,402
1954	2,311,558	3,190,000	5,501,558
1955	2,650,000	5,650,000	8,300,000
1956	2,833,365	8,271,417	11,104,782
1957	3,000,000	10,000,000	13,000,000
1958	3,000,000	15,000,000	18,000,000

United States

Personalities in the News



H. DeWITT SMITH (left) congratulates HERBERT HOOVER, JR., former Under Secretary of State, who was awarded the Herbert Hoover Medal at the recent American Institute of Mining, Metallurgical, and Petroleum Engineers annual meeting in New Orleans. The award, sponsored by AIME, the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, was established in honor of the recipient's father, who was the first to receive it. The medal is awarded "in recognition and appreciation of those principles and ideals of civic obligation and of public service exemplified by the life and work of Herbert Hoover." The presentation was made by Mr. Smith, who is former AIME president.

William L. Kendrick has been moved up from kiln superintendent at Manganese, Inc., Henderson, Nevada. He joined the company in 1954, after seven years with Lone Star Steel Company, Daingerfield, Texas. Prior to that he had spent 22 years in Minnesota iron mining. He replaces **John S. Anderson** who has joined Utah Construction Company at Riverton, Wyoming as project manager on the Lucky Mc Uranium Company project. **Harry Cartwright,** who has been kiln foreman at Manganese, Inc., is the new assistant kiln superintendent.

Sydney Ackerman of Palo Alto, California has been chosen president of Royal Uranium Corporation to replace **George H. Patterson,** resigned. General offices will be moved from the Walker Bank Building in Salt Lake City to Palo Alto. **Aaron Richards,** San Jose, California, was named vice president and treasurer; **Peter Anderson,** San Francisco, secretary; and **Mrs. Gail P. Hardin,** San Jose, assistant secretary and assistant treasurer. The company has holdings in Wyoming and the Indian Hills area of Utah.

William T. Pettijohn has been appointed assistant to the vice president in charge of mining and exploration of the New Jersey Zinc Company. His headquarters are in New York.

Wesley Allen has been named superintendent of the Consolidated Feldspar Department of International Minerals and Chemicals Corporation, Kingman, Arizona. He succeeds **J. D. Howell,** who resigned in March. Mr. Allen joined Consolidated Feldspar in 1950 at Erwin, Tennessee, and continued with International Minerals after the merger of the two firms. In 1955, he went to New Mexico with the Petaca Mining Corporation, the position he leaves to take over as superintendent of the open-pit mine and grinding plant at Kingman.

Robert Wilson, formerly with the Atomic Energy Commission at Grand Junction, Colorado, has been appointed mineral examiner for the U. S. Forest Service to handle the southern Arizona territory. He is stationed in Phoenix, working from the offices of the Tonto National Forest, 104 North Fifth Street.

Frank G. Breyer of the metallurgical consulting firm of Singmaster & Breyer has returned to his New York headquarters after a trip to Aruba, Dutch Antilles where he inspected the plant his firm engineered to produce fresh water from salt water. He also inspected lateritic nickel deposits in the Dominican Republic.

Two new members have been elected to two-year terms on the board of directors of the Perlite Institute. They are **Lewis Staerker,** sales manager of the Southern Division of Tennessee Products and Chemical Corporation, and **Lewis Williams,** president of Perlite Industries of Arizona, Inc. **Norman E. Braun,** operations manager of the Cleveland Gypsum Company, was named by the board to fill a third vacancy until the 1958 annual meeting.

Gene K. Ealy is the new director of engineering and geology for United Western Minerals Company, of Santa Fe, New Mexico. He was previously supervisor of exploration for the Colamer Corporation. **Bobby Gene Donegan,** a graduate of the University of Texas, has been added as staff geologist. **Tom Thorn,** a mining engineer, geologist, and licensed surveyor, has left the staff of Chapman & Wood, Albuquerque, to join United Western.

John F. Campbell, Spokane attorney, has been elected president of North Star Uranium, Inc. to succeed **R. C. McKelvie,** formerly of Calgary, Alberta, Canada. Mr. Campbell, who is also a director of Daybreak Uranium, Inc., was vice president of North Star until his promotion. **Arnold F. Larson,** secretary-treasurer of Wellpinit Uranium Associates, whose land holdings were taken over by North Star, was elected vice president and a director. **Sam W. Farber,** former secretary-treasurer, was elected treasurer, and **Arthur C. Townsend,** former office manager, was named secretary.

Hendrik Seaney has been named acting mine safety engineer for San Manuel Copper Corporation, San Manuel, Arizona. He was employed by Magma Copper Company at Superior for a year before going to San Manuel in 1954. Mr. Seaney replaces **William Savage,** resigned.

Richard N. Miller has been appointed to the new position as assistant to the president of Vitro Uranium Company, Salt Lake City. He joined Vitro's uranium division in 1948 as an engineering trainee and was appointed plant engineer in 1954. **Leslie D. Lash,** who has been named senior engineer, joined Vitro in 1955 as a chemical engineer. **Tony G. Rukavina** has been appointed plant engineer. Mr. Rukavina joined the company in 1952 as maintenance superintendent.

R. L. Sayrs has become superintendent of the Flat Gap operation of the New Jersey Zinc Company, at Treadway, Tennessee. **A. C. Savage** has been made mine chief of the Jefferson City, Tennessee property, and **K. R. Winslow** will serve as mine chief of the Austinville, Virginia property.

Garvin Augustadt has been promoted to mine superintendent of Magna Copper Company, Superior, Arizona. **Cecil Tomerlin** is the new assistant mine superintendent and **Robert Maynard,** division foreman.

Hatfield Goudey is geologist in charge of the newly established field exploration office in Reno for American Exploration & Mining Company of San Francisco. The office is located at 35 East Taylor Street and will be available for examination and exploration of mineral deposits in Nevada and adjacent areas.

C. Jay Parkinson, vice president of Anaconda Aluminum Company, has been appointed general counsel of The Anaconda Company, parent organization. He will continue to serve as vice president and director of Anaconda Aluminum.

Charles A. Steen, president of Utex Exploration Company, was honored recently by the Utah State Senate, which passed Senate Resolution No. 1 in appreciation of Mr. Steen's efforts in developing the uranium mining industry in Utah.

H. Rush Spedden has been named director of research for Union Carbide Ore Company, a division of Union Carbide and Carbon Corporation. He will be responsible for Union Carbide Ore's

STANLEY H. COHLMEYER (left) has been named by Columbia-Geneva Steel Division of United States Corporation to direct the test activity of the company's Wyoming exploration program which is aimed at developing a new source of iron ore to meet the growing western demand for iron and steel. It is known as the "Atlantic City" project after a ghost mining town near the site. CARL W. ROBERTSON has been appointed assistant on the project. Mr. Cohlmeyer joined U. S. Steel from Western-Knapp Engineering Company of San Francisco, where he was project engineer and chief estimator. This firm is doing preliminary engineering on the Wyoming project for Columbia-Geneva. Mr. Robertson was formerly in charge of community relations at White Pine Copper Company.

operations at the corporation's nuclear research center in Sterling Forest, New York. Since 1952, Mr. Spedden has been in charge of the minerals research department of the corporation's research laboratories at Niagara Falls, New York. Previous to his association with Union Carbide, he was assistant professor of mineral engineering at Massachusetts Institute of Technology. He took a leave of absence in 1942 to serve as metallurgist with the United States Foreign Economic Administration in Bolivia on increasing tin and tungsten production.

Adolph Q. Lundquist has been named a vice president of Union Carbide Nuclear Company, a division of Union Carbide and Carbon Corporation. Mr. Lundquist had been general manager of the company's Colorado Plateau operations since 1955. **Dr. Frank W. Hurd** has been chosen director of research for Union Carbide Nuclear.

S. W. McDougall, manager of mines for the Bunker Hill Company at Kellogg, Idaho, also has been appointed director of mine operations for Pend Oreille Mines and Metals Company, northeastern Washington lead-zinc producer which is partly owned by Bunker Hill. He will plan and direct an expanded program of underground development and mining.

Huntly M. Campbell, former general manager of Olin-Mathieson's Metal Division, has been appointed general manager of the company's wholly owned subsidiary, Hayden Metals, Inc.

John M. Barry, attorney from Sparks, Nevada, has accepted the position of advisor to **Vernon Pick,** manager of Pick Enterprises, and has moved to Saratoga, California, headquarters of the Pick interests. Mr. Pick first engaged Mr. Barry after acquiring several cinnabar claims in the Ivanhoe district north of Battle Mountain, Nevada.

Galen G. Waddell, mining engineer formerly with Goldfield Consolidated Mines Company, Colville, Washington, has been added to the Spokane field office staff of the Bureau of Mines.

STANLY A. EASTON (left) has retired as chairman of the board of The Bunker Hill Company and was named honorary chairman and director emeritus. IRA B. JORALEMON was elected to the board of directors to fill the vacancy. No new chairman has been named. Mr. Easton started full-time employment with Bunker Hill in 1903, was appointed general manager later the same year, and in 1933 was named president. He was president for 21 years, until 1954, and that year became chairman. Mr. Joralemon has been a mining consultant to Bunker Hill since 1947, and just recently was appointed to the company's planning and development committee. He has been an independent mining consultant in San Francisco for 35 years.

Obituaries

Robert Tunstall Walker, 77, president of Walker Engineering Corporation, mining geologist, and author, died recently at Colorado Springs, Colorado. He wrote two technical books combining ideas garnered from his years of geological field work and his wide reading. They are *The Origin and History of the Earth* and *The Origin and Nature of Ore Deposits.*

Anton Skubic, member of the Skubic Brothers Company on the Mesabi Iron Range, died recently at the age of 48. The Skubic Brothers operated the Virginia mine and concentrator near Virginia, Minnesota, and owned and operated an equipment and vehicle sales office and repair garage in Virginia.

Joseph F. Joy, 73, founder of the Joy Manufacturing Company, died at his home in Ft. Pierce, Florida recently.

Clarence V. Saylor, 53, chairman of the Montana section of the American Institute of Mining, Metallurgical and Petroleum Engineers, died in Butte, Montana. Mr. Saylor had been general superintendent of the Great Falls reduction department of The Anaconda Company since March 1956, and joined the company in 1925.

Azro Nathaniel Lewis, 73, president of the Original 16-to-1 mine at Alleghany, California, died at his home in San Francisco. The gold mine is one of the oldest still operating in the United States.

George E. Long, past president and retired chairman of the board of Koehring Company, died in Milwaukee at the age of 70.

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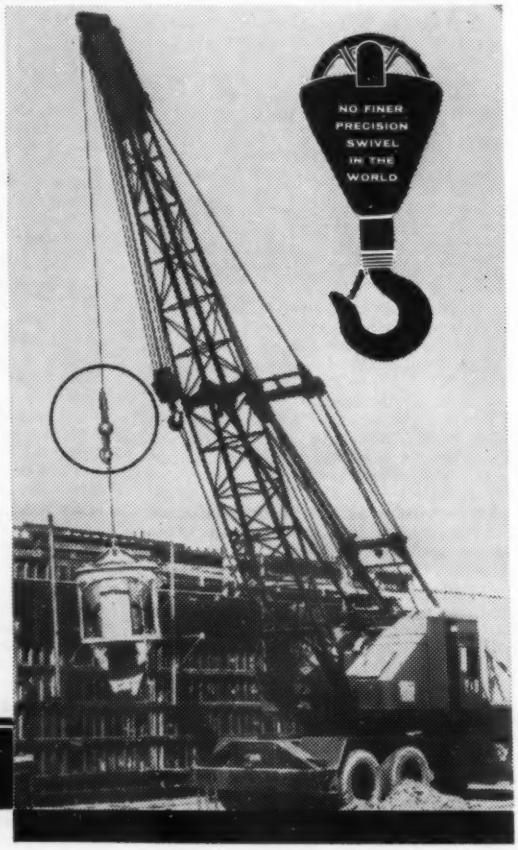

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Newsmakers in International Mining

R. G. "Nik" CAVELL (right) of Ottawa, administrator of the Canadian Colombo Plan, is shown in Colombo, Ceylon inspecting an aerial photograph of the island which has been completely photographed by Photographic Survey Corporation of Toronto under the auspices of the Colombo Plan. DR. R. L. OLIVER (left), Toronto, chief geologist of the survey, explains how the photographs will be used to inventory possible mineral wealth of the island. The survey, which will be used for irrigation, hydro-electric, and agricultural planning as well as mineral development, will be completed in 1958.

Parke A. Hodges, vice president of Behre Dolbear & Company, Inc., mining, geological and metallurgical consultants, has been doing professional work in Liberia and Sweden.

Homer S. Anderson, resident engineer of the New York and Honduras Rosario Mining Company, New York, has been named vice president of the company's subsidiary, Rosario Exploration Company.

Robert D. Ferron, manager of the South American division of Kennecott Copper Corporation's Exploration Department, is changing his headquarters from Lima, Peru to Rio de Janeiro, Brazil.

H. Robiliart, managing director of Union Minière du Haut Katanga, has been elected chairman of the Cobalt Development Institute which was set up early this year in Brussels, Belgium. **E. C. Baring**, Rhokana Corporation, and C. **Piedboeuf**, Centre d'Information du Cobalt Ltd., were named vice chairmen. The Institute is a technical and scientific organization, composed of the world's major cobalt producers, with aims of developing the existing uses of cobalt and discovering new ones. The Belgian company, Centre d'Information du Cobalt Ltd., has been entrusted by the Institute with the execution of its program which is to have no commercial activity. The Institute is represented in the United States by the Cobalt Information Centre at the Battelle Memorial Institute at Columbus, Ohio.

HENRY BRIMO was named "Mining Leader of the Year" in the Philippines for 1956. Mr. Brimo is president of Baguio Gold Mining Company and Philex Mining Corporation, and president of the Philippine Gold Producers Association. In the latter role he was honored for the part he played in the establishment of a subsidy program for the gold mining industry, which prevented the imminent closure of several gold mines. He was also cited for his pioneering efforts to establish new base metal mines.

Professor P. Ramdohr, professor of mineralogy and petrology at the University of Heidelberg, Germany, is on a lecture and study tour of the Union of South Africa, in connection with the nature and source of the gold and uranium ores of the Southern Transvaal and Free State. In one lecture Dr. Ramdohr compares "the uranium ores of the Blind River district in Canada and the Witwatersrand bankets." Also visiting the Union are **Dr. P. H. Dodds**, United States Atomic Energy Commission; **Dr. L. Page**, head of the uranium division of the United States Geological Survey; and **Dr. S. H. V. Bowie**, head of the uranium division of the United Kingdom Geological Survey.

A. C. Annfield has succeeded **S. Taylor** as secretary of the Chamber of Mines of Northern Rhodesia.

Mr. Becker has been appointed as mining engineer at the Djawatan Geologi at Bandung, Indonesia, along with **Mr. Bothmann**. Mr. Becker is from the United States and Mr. Bothmann is from Germany, but has been in mining business in the Middle East for 12 years.

Robert Annan, chairman of Consolidated Gold Fields of South Africa, Ltd., England, and internationally-known mining engineer, has been named 1957 recipient of the Egleston Medal, Columbia University's highest award for "distinguished engineering achievement." Mr. Annan is a graduate of the Columbia School of Mines, class of 1909. He was first employed, after graduation, at Ray Consolidated Copper Company in Arizona, and in 1912 left Ray to become assistant engineer to **Sir A. Chester Beatty** in New York. The following year he was transferred to Mr. Beatty's London organization, and in 1919 was made mining engineer for Selection Trust Company, Ltd. From 1920 to 1924 he was consulting engineer for National Mining Corporation in London, conducting mine examinations and doing consulting work in Mexico, Colombia, and Europe. For the following four years he was managing director of National Mining. Since joining Consolidated Gold Fields in 1930, Mr. Annan rose from resident engineer in London to director, managing director, and, since 1944, chairman. The Egleston Medal Award was first presented in 1939 to honor Thomas Egleston, who founded the first school of mines in the United States at Columbia in 1864 and was its head until 1897.

Gordon I. Gould, president of Gordon I. Gould and Company, has returned to his San Francisco, California headquarters after an examination trip to mercury mines and prospects in Italy, Spain, and Venezuela.

CLYDE E. WEED, president of The Anaconda Company, has been presented by the Chilean government the award of Knight Commander of the Order of Merit of Bernardo O'Higgins. Sr. Gustavo Luco, undersecretary of foreign affairs, in presenting the award said the "decoration represents the gratitude of the government and the people of Chile for the cooperation they have received from The Anaconda Company, and above all, it represents our acknowledgement of the noble spirit of comprehension and affection you have shown for our country . . ."

Viktor Epstein, assistant mine superintendent of the Kiruna iron mines of Sweden, is attending the University of Minnesota School of Mines under a Swedish-American fellowship.

John Hatch left the staff of International Minerals and Chemical Corporation in Bartow, Florida, to accept a position with a mining organization in South America. He will be stationed in British Guiana.

W. P. Smith, superintendent of Southern Peru Copper Company's Toquepala copper mine, visited recently in Arizona.

Donald Virant has taken over his new position as chief mining engineer for the Hilton Mines, Shawville, Quebec, Canada. He was formerly in Hibbing, Minnesota as mine engineer at the Mahnomen open pit mine of Pickands Mather & Co.

John J. Miller has been appointed general manager of the Alumina Division of Olin Revere Metals Corporation. He will be in charge of the Olin Revere alumina facilities now under construction at Burnside, Louisiana. Mr. Miller was formerly in charge of major alumina plants in Canada and India for the Aluminum Company of Canada, Ltd.

BERTIL ASTLIND of Adakgruvan, Sweden will leave for Istanbul, Turkey in June to become technical manager for Türk Maadin Cirketi, a mining company with chrome, coal, and molybdenum mines in Turkey and Cyprus. The picture was taken in Greenland when he was local manager for Northern Mining Company, of the Mesters Vig lead-zinc mine and mill in the northeastern corner of Scoresby Land. In Sweden he is mine superintendent of Boliden Mining Company's mines in the Adak district.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

New Diesel Truck for Underground Mining

Here's a new Diesel truck called the "Ore-Master" developed specifically for underground mining. The "Ore-Master" can haul up to eight tons, and is only 78-inches wide and 4½ high. Total weight of the unit, including scrubber, is 10,180 pounds. Powered by a GM Diesel engine, and containing an Allison Torqmatic transmission, the unit was designed on specifications of a large mining company, and has been thoroughly field tested for a considerable period. Having three speeds in either direction (two for loaded use), a heading can be worked without turning the truck around. For additional information and brochure, circle No. 48.

West German Company Plans Expansion Program

Phoenix-Rheinrohr AG., one of west Europe's largest steel and pipe producers, plans to expand its crude steel production from the present 2,400,000 metric tons annually by 25 percent, to 3,000,000 tons in 1960.

The company's total investment in new plants, machinery, and equipment will reach $275,000,000 by 1960.

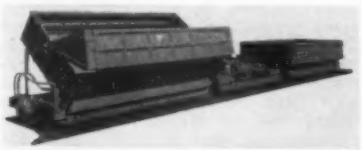
Alumiron Pipe Couplings Made of Iron or Aluminum

A new economical and flexible coupling for grooved end pipe is now available from the manufacturer, Charles E. Manning Co. of Pittsburgh. Available in either malleable iron or aluminum, the couplings are furnished with Buna N or Neoprene gaskets.

Alumiron couplings are stocked in 1, 2, 2½, 3, 4, 5, 7 and 8 inch sizes, and are made to fit standard grooved pipe. For descriptive literature and prices, circle No. 46.

Hawthorne's New Type MP Replaceable Blade Bit

Now available is the new Hawthorne "MP" Blue Demon replaceable blade bit. Developed by the Herb J. Hawthorne Co., the bit was designed specifically for small hole rotary drilling in the uranium field, minerals exploration, and diamond core drilling field. The bit is available with tungsten carbide faced finger or carbide inserted blades in AX, BX, and NX sizes. Other fractional sizes are available up to three inches in diameter. Circle No. 51 for further information.

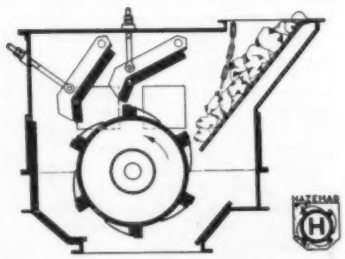


Sanford-Day Develops A Self-Dumping Granby Car

A hydraulic, self-dumping Granby type car has been developed by Sanford-Day Iron Works, Inc. Cars have a pair of telescopic hydraulic cylinders that raise the body to a dumping angle of 40 degrees. Dumping is controlled by a four-way valve on each car, which is manually actuated by a lever at the side of the underframe by the trip rider. Hydraulic power is supplied by a power unit mounted on a small car that is coupled in the trip. Hydraulic hoses connect cars by means of quickly connected and disconnected self-sealing couplings. The car body raises or lowers in less than 30 seconds. The S-D Hydraulic Self-Dumping Car pictured has a 10-ton capacity, and is approximately 17 feet long, seven feet wide, and less than four feet high from top of rail. Circle No. 60 for additional information.

HAZEMAG-Impact-Crusher (System ANDREAS)
Type AP 5 Br.
(capacity: approx. 200-400 t/h)

Principle of HAZEMAG Impact Crusher
(System ANDREAS)



Hazemag Impactor Has High Reduction Ratio

The Hazemag heavy-duty, fine-crushing impactor, Type AP 5 Br., illustrated above uses very heavy rotating masses to achieve exceptionally high reduction ratios. Fineness of crushing is regulated both by the speed of the machine and the clearance between the impact plates and the blades. Impact plates are gravity hung and retract to allow passage of foreign bodies without damaging the crusher.

As there are no cages, bars, etc. in the Hazemag design, wear is far lower than is usual with other machines of the impact type according to the manufacturer. The AP 5 Br. is rated up to 400 tph. Hazemag crushers are available in sizes from 50 to 500 tph. For further information, circle No. 47.

PETER WALLENBERG has been appointed to the position of the recently established air compressor division of Atlas Copco Eastern, Inc., of Paterson, New Jersey. Mr. Wallenberg joined Atlas Copco AB in Stockholm, Sweden in 1954.

UPPER 3 CARDS ENABLE

INTRA-SET DRILL STEEL: Carbide tipped, Intra-Set drill steels, both chisel type and 4-point integral, are described in a new Brunner & Lay brochure. According to Brunner & Lay, it is the only known maker of the 4-point integral bit steel. Prices and sizes are included in the brochure. Circle No. 1 for your copy.

STANDARDIZE ON TUBE MILL LINERS: The new Babcock & Wilcox tube mill liners are designed to fit all sizes of mills, permitting standardization. This materially reduces your liner inventory. Labor costs and down-time are reduced as the B & W lines are easily handled due to small size and weight. You'll want more information, so circle No. 2.

VERSATILE D.D. MACHINE: Sprague & Henwood has a brochure devoted to its Model 30 core drilling machine. The Model 30 is a compact, lightweight drilling machine designed for drilling in any formation under the most difficult conditions. Capacities range up to 600 feet using "EX" equipment and approximately 300 feet with the larger "NX" size. Circle No. 3 for the Model 30 brochure.

FRICTION MATERIAL SELECTION CHART: Johns-Manville offers a reference booklet containing descriptions of its complete line of J-M Asbestos Friction Materials and a handy selector chart. If your operations use hoists, dredges, winches, shovels, draglines, aerial tramways, cranes or other similar equipment, you will want this reference booklet. Circle No. 4.

PACKINGS AND GASKETS CATALOG: Johns-Manville has a catalog available describing its complete line of J-M Packings and Gaskets—rod, plunger and valve stem packings, sheet packings, oil seals, metallic and non-metallic gaskets. For a copy, circle No. 5.

WATCH YOUR HMS OPERATION: The open top and sides construction of the Ore & Chemical Corp.'s HMS Vessel permits continuous inspection and easy accessibility. According to the manufacturer, the low installation cost and simplicity of operation—only one moving part—mean substantial economies. For details of the OCC HMS Vessel circle No. 6.

SUPER SERVICE MINING CABLES: General Cable Corp. offers a catalog entitled "Super Service Heavy Duty Portable Cords & Cables" to users of mining cable. All types of portable cables are described and illustrated. Circle No. 8.

PORTABLE pH METER: Analytical Measurements, Inc. offers a portable pH meter that registers pH instantly. The instrument is 3 x 5⅞ x 2½ inches and weighs only 3 pounds. For further information, circle No. 10.

List information you want MINING WORLD to obtain for you on this card. WE'LL DO THE REST. No postage necessary if mailed in U. S.

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500 HOWARD STREET
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CALIFORNIA
U. S. A.

DIAMOND DRILLS FOR ANY JOB: Joy Mfg. Co. offers diamond drills with capacities ranging from 500 to 4,000 feet. The skid mountings, compact design, and rugged construction make it possible to drag Joy diamond drills into some of the most inaccessible locations. Because they are available with either hydraulic or screw-feed swivelheads and with a choice of gasoline, electric, or air power the core drills can fit into any drilling program. A bulletin is available describing Joy's line of diamond drills. Circle No. 7.

FRICTION-DRIVE HOIST DATA: Aros Electric, Inc., U.S. representative for ASEA Hoists, has available to interested readers comprehensive data on multiple-rope friction-drive hoists. If you are considering a hoisting installation you will want to find out more about the ASEA hoists. Circle No. 11.

FEEDER AND CRUSHER BULLETINS: McLanahan & Stone Corp. offers two bulletins describing its reciprocating plate feeder and the Rockmaster crusher. Available as component parts or as separate units, the feeders and crushers are designed for economical feeding and crushing at 1,000 tons-per-hour or more. Circle No. 12 for your copies of these two bulletins.

CHUTE VIBRATORS: The Eriez Manufacturing Co. have now available small chute vibrators to help flow of fine material passing through metal chutes. Vibration is caused by the teaming of an electromagnet with an Alnico permanent magnet which operate to set a kneading action in chute walls, imparting a rapidly oscillating directional thrust to the material being handled. Circle No. 13 for additional information.

PNEUMATIC POWERED TRACTORS: The Westfall Equipment Co. have available for you a catalog describing their line of heavy earth-moving equipment and tractors. The tractors feature four-wheel drive, short turning radius, automatic weight transfer. Circle No. 25 for your copy.

REAR-DUMPS: Euclid Division of General Motors has recently published a new catalog on their four new rear-dump earth-moving models. Capacities of units described range from 12 to 40 tons. For your copy write the Euclid Division at Cleveland 17, Ohio.

IRON WOOD: Information is available for you on Ekki or iron wood, which is according to the supplier among the world's hardest woods, and is very resistant to abrasion. The supplier, F. Henery & Sons also have information on Autacon, another hardwood, which is resistant to acid, rot, termites and abrasion. For further information on these African imports, circle No. 26.

List information you want MINING WORLD to obtain for you on this card. WE'LL DO THE REST. NO postage necessary if mailed in U. S.

A NEW TEST LAB for determining, in advance, critical carrying velocities and friction losses of coal refuse, tailings, and other abrasive slurries, has been developed for its customers by Morris Machine Works, Baldwinsville, New York. Reportedly the only lab of its type in the country, it enables the firm to recommend pump and pipe sizes that will most efficiently handle particular slurries. For further information, circle No. 9.

A NEW MOBILE AM radiotelephone, designed to provide reliable long distance communications under adverse terrain conditions is available from Kaar Engineering Corp. Designated the TR 245, this 50 watt, 2-way unit, operating on either 6 or 12 volts, was developed specifically for mining and geological field work. Circle No. 14 for further information on this small 27 pound unit.

HIGH TENSION SEPARATORS: The availability of a four-page technical bulletin on high tension separators has been announced by Carpco Manufacturing, Inc. Containing a comparison of electrostatic with high tension or electro dynamic separation, the bulletin lists typical minerals which can be separated. Other valuable metallurgical information is also included. Circle No. 15.

MAKE MINE SAFETY is the title of a new 16 mm sound-color film on the use of rock bolts in various mine applications. The film, made available by the Colorado Fuel and Iron Corporation, shows the installation and advantages of rock bolts at three representative mines. Actual production of rock bolts at CF&I's Pueblo, Colorado plant is also shown. Copies of film available upon request, or circle No. 16 for further information.

SCRAPER BULLETIN: Design, engineering, construction and operating features of the Allis-Chalmers TS-360, 20 cubic yard motor scraper are described in a new 16-page catalog now available from the Construction Machinery Division, Allis-Chalmers Manufacturing Co. Pictures and illustrations help tell the TS-360 story in an interesting manner. Circle No. 17 for your copy.

WHITE DIESEL: White Diesel Engine Division of White Diesel Company have released a comprehensive brochure describing their line of four cycle, six or eight cylinder, Diesel engines. These engines are available either naturally aspirated or supercharged, with horsepower rating up to 750 b.h.p. Circle No. 18 for your copy.

CORE DRILLING HANDBOOK: Publication of the second edition of a helpful handbook on diamond core drilling has been announced by the Joy Manufacturing Company. Entitled "Do's and Don'ts for Diamond Core Drilling," the handbook sets forth in simple terms basic techniques which apply to all diamond drilling. Circle No. 19 for your copy.

MAGNETIC SEPARATION: The design and application of high intensity induced roll magnetic separators is discussed in a technical bulletin, offered by Carpco Manufacturing, Inc. Description of machines engineered to provide clean separation at high feed rates is included along with a full list of highly magnetic, magnetic, weakly magnetic and non magnetic substances which are separated by Carpco equipment. Circle No. 20 for your copy.

TD-24 BROCHURE: International Harvester Company has recently made available an eight-page brochure on the 200 hp TD-24, largest in the IH crawler line of seven units. The brochure fully describes the unit, emphasizing the solid framework, planet power steering, and the option of torque converter or gear drives. Diagrams and cutaway drawings fully illustrate integral parts of the tractor. Circle No. 21 for your copy.

TIGER BRAND SH-D Cable is described in a new brochure published by Columbia-Geneva Steel Division of United States Steel Corp. This flexible, heavy insulated three conductor cable, provides a high degree of safety and reliability in service up to 15 KV. Circle No. 22 for additional information.

BLASTING METHODS: A new brochure outlining current information on drilling, blasting and excavating methods used by the mining industry, has been published by the explosives Department of American Cyanamid Company. Circle No. 23 for your copy of this informative brochure.

A NEW HOSE for pneumatic drills has been developed by Hewitt-Robbins, Inc. for heavy-duty use in mines, and other types of service requiring a hose that is tough yet light and flexible and easy to handle. Having a natural cover of natural rubber having a tensile strength of over 2,000 psi, the hose will be marketed under the name of Durail Air Drill hose. For further information circle No. 24.

INCREASE HAULING with a "Dumptor." This is the subject matter of a new 24-page illustrated bulletin published by the Koehring Company. The bulletin shows how hourly haul output can be increased by approximately 20 per cent. On-the-job photos, combined with schematic drawings, show how fast spotting, elimination of turns and a one-second gravity dumping operation make this additional work load possible. Circle No. 27.

GEOPHYSICAL SUPPLIES: Highly portable ground-type Vertical Force Magnetometers, Electromagnetic Units, and Self Potential and Resistivity Units are available from the Geophysical Instrument & Supply Company. Information on this supply of accurate and durable Sharpe instrument is available by circling No. 28.

NONFLAMMABLE SOLVENTS that will bite into and remove oil, grease, and dirt without harming delicate metal parts or electrical insulation, yet are safe enough to use in ordinary work areas with conventional ventilating equipment, are now available to solve a wide range of industrial cleaning problems. The new solvent is marketed by the DuPont Co. under the trade name "Freon." Circle No. 29 for additional data.

ILLUSTRATED LITERATURE is now available from the Wedge Wire Corporation on their line of Migh-T-ee Kleenslot Wedge Wire Screen. This screen features a precision assembly and unique profile which guarantees long life, non-blinding and independent flexing actions. When used as a vibrating screen, Kleenslot is particularly adaptable in maintaining openings between the division bars of smaller than $\frac{1}{8}$ mm and larger than ordinarily considered economical. Circle No. 30 for your copies.

HEAVY MEDIA SEPARATORS: The Colorado Iron Works Co. have available for you a new booklet on their Akins Heavy Media Separators and Densifiers. Complete descriptions of these units are included in this interesting booklet. Receive your copy by circling No. 31.

WARN LOCKOMATIC HUBS: The Warn Lockomatic Hubs for four wheel drive vehicles automatically turn your vehicle into a "free wheeling" two wheel drive, or into a four wheel drive as you shift gears. There are no special attachments necessary. When traveling on good roads it's advantageous to use two wheel drive to reduce front end wear, and gear whine, as savings in fuel and repairs result. Circle No. 32 for additional information.

COTTRELL AUTOMATION: A brochure describing the Cottrell automation system recently announced by Research-Cottrell, Inc. has been made available. The CA system brings complete automation to the power inputs of electrostatic precipitators, eliminating manual adjustments. Circle No. 36 for your copy.

SAMPLE SPLITTER: A new bulletin is available from Carpco Manufacturing Inc., describing a highly accurate line of precision built splitters designed for sampling fine materials. The various models are constructed with stainless steel splitter blades held rigidly between machined aluminum alloy blocks. Circle No. 41 for a copy.

"55" PAYSCRAPER: International Harvester Export Co. 180 N. Michigan Ave., Chicago, Ill. have announced the availability of a new brochure describing the new IH series 551 Payscraper. The self-propelled earthmover features fast loading, fast dumping and rapid acceleration. Write IH Export for your copy.

HOT FORGED CHISELS and related items, for both hand and pneumatic machine use are the subject of a new catalog published by the Bedford Tool and Forge Company. Circle No. 42 for your copy.

PIPE LINING: Pipe Linings Inc. of Wilmington, Calif. specialize in pipe protection problems. Their Centriline Process applies smooth continuous leakproof lining to inside of 16-inch to 144-inch pipe lines in place. Corrosion and interior leakage may be stopped in this manner, as well as the full restoration of flow coefficients. Circle No. 43 for additional information.

SCREEN SKID BARS: Hendrick Mfg. Co., have available their Hendrick skid bar mounted on Wedge Slot Screens. Skid bars mounted in this manner protect the screen from the impact of heavy boulders, thus prolonging screen life. Circle No. 44 for additional information.

POWER UNIT CATALOG: The Detroit Diesel Engine Division, General Motors Corp., Detroit 28, Michigan, have issued a 19-page catalog outlining its complete line of power units for all industrial applications. Specs are given on 31 engine models ranging from 44 to 761 brake horsepower, including the division's new six-cylinder Turbopower engine. Write to the company for your copy.

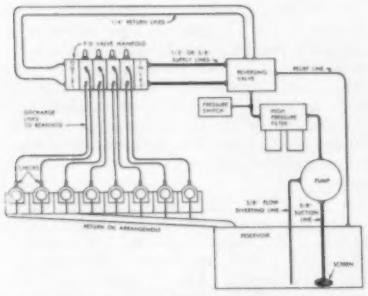
IH MINING TOOLS: International Harvester has just released an 8-page brochure, which displays the entire IH construction equipment line at work on mining jobs throughout the country. Many on-the-job photos of IH equipment are included in the booklet. Learn more about IH mining equipment by writing IH, Consumers Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill.

FOLDER 2749, just published by Link-Belt Company, gives detailed information and tables listing stock sizes, torque ratings, hub dimensions, and keyseats, on the new Link-Belt sprockets with shear pin protection. Examples for selection and "problem and solution" instructions are detailed. Circle No. 34 for your copy.

TRACTOR ATTACHMENTS: How addition of the right tractor job attachment increases production and profit on virtually all types of heavy duty jobs is cov-

ered in an informative brochure offered by Hyster Company. Shown in the catalog are the complete line of tractor-mounted accessories for Caterpillar-built tractors. Circle No. 35 for your copy.

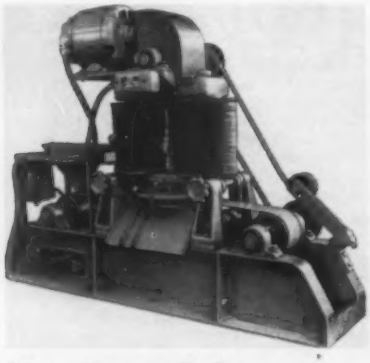
ORE DRESSING PUBLICATIONS: The American Cyanamid Company has available for you a series of brochures on ore dressing. They cover the chemistry of cyanidation, HMS processes, Cyanamid reagents, froth flotation, and the handling of Aero Brand Cyanide. Circle No. 33 for your copies.



New Lube System Advances Circulating Oil Methods

The Farval Corp., manufacturer of centralized systems of lubrication, has announced the development of a new type of circulating oil system known as "Lubrival." This system employs the Farval two-line principle of operation to supply oil under pressure to Progressive Dualine measuring valves for delivery to bearing points. The valves have individual sight indicators and feature the positive piston displacement method of feeding lubricant.

Lubrival monitors its own operation through a pressure sensing mechanism to warn of clogged or broken lines in any part of the system. According to the company, circulating oil systems heretofore have failed to provide indication of broken discharge lines. Circle No. 52 for additional information and free brochure.



New Magnetic Separator for Selective Analysis

The successful application of a magnetic separator, which provides a positive method of determining the feasibility of magnetic concentration of minerals, has recently been announced by Stearns Magnetic Products, 635 South 28th St., Milwaukee, Wisconsin.

Called the Stearns Ring-Type "D" Separator, the unit operates by passing the material through the high-intensity magnetic field produced by the rotating magnetic ring. The mechanism employs a "free lift" principle of separation, in that the magnetics contained in the feed material are lifted from the mixture as it passes beneath the take-off ring. This minimizes the incidental mechanical entrapment of associated minerals in the product being removed and contributes to maximum selectivity. The unit, usually used in the lab, may also be used for metallurgical control, or in small concentrating plants. Write to the company for further information and free brochure.

Stench Warning Cartridge To Warn Mine Workers

Reed Engineering of Los Angles have developed a new Stench Warning Cartridge, containing a U. S. Bureau of Mines approved non-explosive mixture of ethyl, mercaptan and freon. The cartridge, forming an integral part of the stench warning system, is connected to the compressed air lines. In case of an emergency, the cartridge is easily punctured, allowing the chemical mixture to enter the air line, warning miners in all parts of the mine where compressed air is being used. For additional information circle No. 50.

New Rock Drilling Crawler Cuts Drill Time Up to 30%

The new "Drillcat" rock drill crawler introduced by the Thor Power Tool Company is designed to cut drilling time up to 30%.

The rig is self-propelled with drill, mast and air-power mounted for one-man operation. Air-operated crawlers enable the machine to move over rough ground or uneven surfaces and will, according to the manufacturers eliminate the need for crews to move the drills into position wherever the machine is to be used. Simplicity of operations for the operator and easy maneuverability are features of the new machine. The "Drillcat" performs the vertical, horizontal and angle drilling operations with added weight of the crawlers lending additional stability with sufficient power to tug the compressor into drilling position also. The machine uses the Thor 105M Drifter Rock Drill and the Thor Wagon Drill Mast as standard equipment. For further information circle No. 45.

Notes From The Manufacturers

Atlas Copco Pacific will establish a branch in the Belgian Congo, its 28th overseas unit. The new company, Atlas Copco Congo S.C.R.L. (Societe Congolaise a Responsabilite Limitee), will be the first compressed air company ever formed in this African colony and will have its administrative offices at Elisabethville, under the management of Mario Pellegrino.

Dorr-Oliver recently broke ground for construction of a new $2,500,000 worldwide headquarters in Stamford, Connecticut. It will house administrative staff members and such departments as finance, sales, advertising, company relations, patent, and a major share of the company's technical divisions.

Clarence Rankin has been named assistant vice president of Pacific Foundry Company, Ltd.

Lloyd H. Christiansen of Minneapolis, Minnesota has been appointed director of personnel at the E. J. Longyear Company. He previously held a similar position at the Klein Super Market chain.

John K. Shoemake has joined the staff of Earnshaws Docks and Honolulu Iron Works, in Hawaii. Mr. Shoemake has several years experience in installation of mining and drilling equipment and was last employed by Chicago Pneumatic Tool Company.

Walter Wehtje has retired after 17 years as managing director of the Atlas Copco group of companies. The parent company is in Sweden. Mr. Wehtje's successor in Stockholm will be Kurt Allan Belfrage.

L. V. Meeker, sales manager of National Carbon Philippines Inc., will be assistant managing director of National Carbon (Eastern) Ltd., which operates factories in Singapore and Hong Kong.

Brunner & Lay, Inc., Franklin Park, Ill. have opened a new plant in Denver, Colo. at 2 Santa Fe Drive where a complete stock of carbide Rok-Bits, Intra-Set and conventional drill steels, bit couplings, adapters and extension steel will be available. Drill steel will be serviced and fabricated at the new plant.

The Scientific Instruments Division of Beckman Instruments, Inc., has announced plans for a new $1,500,000 research and development building which will add 100,000 square feet of working area to the present division plant and corporate headquarters in Fullerton, California. The new unit will be completed about October 1, 1957.

NEW!

GARDNER-DENVER R68

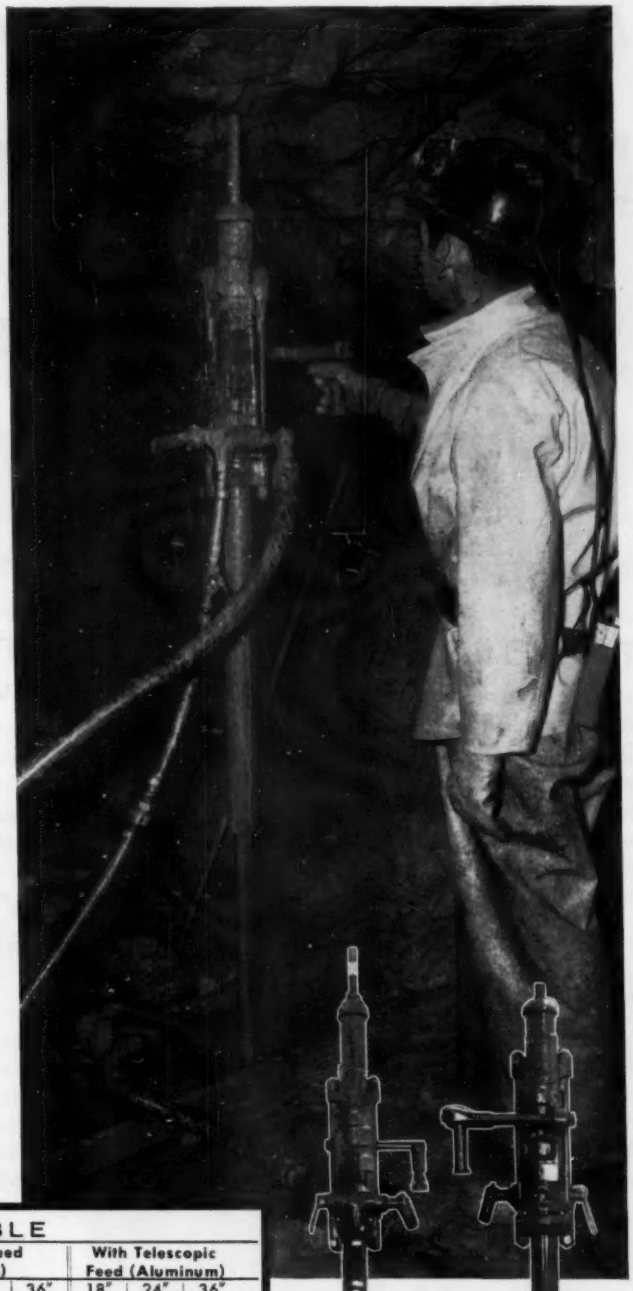
New drilling speed
New ease of operation

Here's a new stoper with added automatic features that increase drilling speed and handling ease. The new R68 has all of the rugged strength, operational efficiency and top manufacturing qualities of all other widely used G-D stopers—another example of Gardner-Denver engineering foresight.

New R68 features:

1. Gardner-Denver automatic water control—operating on the "water on—air on; air off—water off" cycle.
2. Push-button or rotary type feed controls.
3. Equipped with automatic blowing through chuck end—keeps mud and abrasive cuttings out of drill.
4. Is available with collared or tappet chuck. Your choice of direct or telescopic feed.

Write for complete details.



SPECIFICATION TABLE

Model R68	With Direct Feed (Steel)				With Direct Feed (Aluminum)				With Telescopic Feed (Aluminum)		
Steel Change	18"	24"	30"	36"	18"	24"	30"	36"	18"	24"	36"
Weight: (With Tappet Chuck) lb.	94	97	100	103	80¼	82¼	84¼	86¼	90	91	94
Weight: (With Collared Chuck) lb.	89¾	92¾	95¾	98¾	76	78	80	82	85¾	86¾	89¾
Steel Sizes: Hex or Q.O.—⅞" or 1"											

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

Handling materials by crane or locomotive?

Read how Pacific Northwest Alloys switched to Michigan Tractor Shovels and . . .

SAVED $5,000 PER MONTH!

THE BACKGROUND

Pacific Northwest Alloys, Inc., is a wholly-owned subsidiary of Chromium Mining & Smelting Corporation of Chicago. Their plant, located just outside Spokane, Washington, produces an alloy known as low carbon ferro chrome from African, Philippine and domestic ores. This new, fast-melting alloy is used in production of some of the new low carbon stainless steels.

THE PROBLEM

Raw materials, such as chrome ore, limestone and quartz, are stockpiled outside the plant. Formerly, locomotive cranes loaded this material into rail cars; these were moved by a switch engine to unloading hoppers. At the time, this seemed the best method of handling the new materials. Then management saw what Michigan Tractor Shovels could do! Result?

Two Michigans replace two locomotive cranes

Two of the old locomotive cranes were retired, along with most of the hopper cars. Two Michigan Model 175A Tractor Shovels now do the entire job . . . moving *several million pounds* of raw materials per month . . . saving approximately $5,000 per month! And that's not all . . .

Weather no longer slows production

The old method of plant feeding was mainly a warm-weather proposition. Raw materials often froze in the hopper cars, simply wouldn't drop—but *production* did, until Michigans were put on the job. Now, transfer of raw materials is fast *and dependable,* no matter what the weather. Despite haul distances of up to ½ mile, *one* Michigan outworks *two* railroad cranes and the large labor crew formerly used during the winter months. In addition . . .

Switching gondolas is another important part-time Michigan job. Here, a pusher-equipped Model 175A puts its four-wheel-drive and 133 hp to work, moving several 100-ton cars over a spur line to the stockpile area.

Michigans permit new sand pit operation

Pacific Northwest Alloys used to *buy* sand, have it shipped in and stockpiled. But now their Michigan Tractor Shovels have made it feasible to open a small sand pit right on Company property. One of the versatile 2¾ yard Michigans digs the plant's daily requirements (about five loads) and delivers it to the unloading hoppers. It's a one-mile haul, but Michigan's excellent speed makes a dump-truck and driver unnecessary—it's actually less costly to let the Michigan do the whole job!

Plant manager reports low maintenance costs

"We use the Michigans two shifts per day, seven days a week on all kinds of jobs," reports Ralph E. Ebersole, Plant Manager of Pacific Northwest Alloys. "They handle material varying from abrasive sand to metallurgical coke (weighing about 30 lbs per cubic foot) to dense chromite ore (weighing over 200 lbs per cubic foot)—yet maintenance costs have been very minor. Savings in both maintenance and labor are more than paying for the Michigans—and we have absolute assurance of uninterrupted production, regardless of weather!"

If performance like THIS appeals to YOU

. . . get in touch with your local Michigan Distributor. He'll be glad to arrange an in-plant demonstration that'll show you just how Michigan Tractor Shovels can improve your profit picture. Count on him, too, to recommend the *correct* size Michigan for your specific operation—there are eight basic models and 38 buckets and attachments ranging in capacity from 6 cubic feet to 6 cubic yards. Choose the finance plan best suited to your investment program, too—including the popular Michigan Lease-Purchase Plan, which lets you put one or more Michigans in your plant without laying out a penny of capital.

Michigan is a registered trade-mark of

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2493 Pipestone Road
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MAINTENANCE COSTS CUT 80% HANDLING 8,500 lb/yd ALLOY

When Pacific Northwest Alloys had another problem, they did just that . . . got in touch with their local Michigan Distributor in Spokane. This time, they sought an end to the extremely high maintenance needed on their small loaders used indoors to move low carbon ferro chrome to plant shipping tables. A 16 cubic foot Michigan Model 12B was put on trial. Today, Pacific Northwest Alloys has four of these machines. They have replaced *five* of the old 14 cubic foot loaders. Maintenance costs are only ⅓ of what they were formerly.

We ship "as promised"...
in America's Largest Hopper-Car Fleet
another good reason

to specify

Your Westvaco® Soda Ash shipment is never held up by a shortage of hopper cars . . . because Westvaco has 300 covered hopper cars in customer service—by far the largest fleet of modern covered hopper-cars in the chemical industry.

Our modern rolling-stock hauls an extra-high quality product—free flowing, quick dissolving, low-iron, chemically-pure soda ash that saves plenty for users within our shipping area.

If you use ash, we should talk things over. We can probably offer you a bigger value for your money in Westvaco Soda Ash.

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Westvaco Chlor-Alkali Division
FOOD MACHINERY AND CHEMICAL CORPORATION

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BECCO peroxygen chemicals • FAIRFIELD pesticide compounds • FMC organic chemicals • NIAGARA insecticides, fungicides and industrial sulphur • OHIO-APEX plasticizers and resins • WESTVACO alkalis, solvents, phosphates, barium and magnesium chemicals

NOW ONLY 2 LEVERS FOR ALL OPERATIONS

LORAIN Full-Metered

"AIR-EASE" CONTROLS

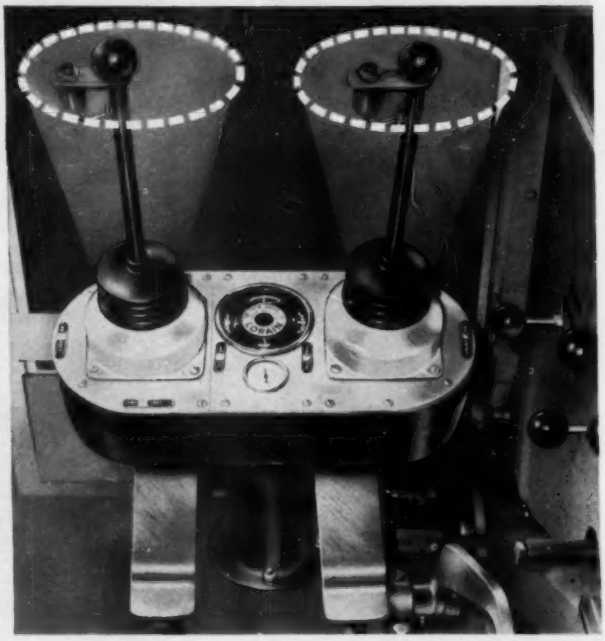
Reduce Operator Effort . . .
Provide Better Control

The latest Lorain advance brings a new era of operation to shovel-crane operators and owners. Now, Full-Metered "Air-Ease" operation controls all friction clutches. Now, two simplified hand levers replace the bank of awkward multiple levers of the past. These two levers put "Metered Air" to work feeding power to the clutches at any rate of flow desired. All of the old time "feel" and response is there, lever manipulation is simplified, effort is greatly reduced, speed is increased, control is more accurate. The range of air flow and power is at the precise command of the operator.

To the operator, here is a new day of operating ease and lack of fatigue. To the owner, no feature in years has added so greatly to production.

To be the first to put the new 2-lever "Air-Ease" control to work on your jobs, see your Thew-Lorain Distributor. Here is a feature your next shovel-crane should have!

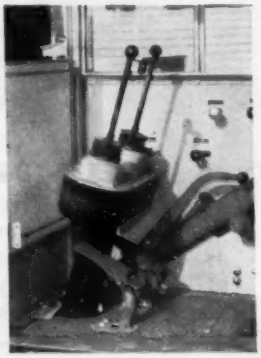
THE THEW SHOVEL CO., LORAIN, OHIO



LEFT LEVER — Dotted circle indicates the "wobble stick" action. By positioning lever in various directions within this circle, operator can swing the turntable right or left, or raise the boom up or down. Intermediate positions within the circle combine any of these operations.

RIGHT LEVER — In the very same rotating action, the operator can control these operations: (1) Main Hoist; (2) Secondary Hoist; (3) Clamshell Holding; (4) Drag or Hoe Drag-in; (5) Shovel Crowd-Retract; (6) Third Drum; (7) Power Load Lowering.

All operations described above are controlled by moving these levers forward or backward, from side to side for single operations, or "quartering" the levers for combined operations. Air booster operation of Hoist Brakes is available.



IMPROVED VISIBILITY

This view shows the clean, simple, 2-lever control arrangement in the operator's cab. Operator gets full view of work area, particularly on deep digging operations.

Intermittently used Full Air controls for crawler steering, turntable swing lock, tread-travel lock, shifting of travel-swing jaw clutches, are conveniently located on panel to right of operator.

The new 2-lever Full-Metered "Air-Ease" controls are now available on eight Lorain models, both crawler and rubber-tire mountings, in 20 to 30-ton range.

THEW LORAIN®

In carrier landings, planes coming in at more than 100 knots are stopped in a split second. This amazing performance is made possible by having each plane hook onto one of several wire ropes stretched across the flight deck. Both plane and rope receive an almost unbelievable shock at the moment of contact. Needless to say, only top-quality wire ropes can be used for this application because . . .

you can't bargain with safety

While your use of wire rope differs from this carrier application, *safety should be just as important to you.* For, although a "bargain" rope may save you money, it can cost you your peace of mind. So don't bargain with safety. Buy a rope that's a *quality* rope—buy Wickwire Rope. 5049

WICKWIRE ROPE
A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

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Dig Faster...

Dump Cleaner...

Last Longer

INCREASE YARDAGE

Any way you look at it — from any angle — it's the taper that makes *ESCO* dragline buckets dig faster, dump cleaner, and last longer.

DIG FASTER. Bucket sides flare outward from the lip to increase loading speed. Materials are not compressed into the opening but allowed to expand and flow up and back along the tapered sizes filling the bucket completely without voids in the rear. Bucket fills in shorter drag distance, less line pull required.

DUMP CLEANER. Taper from front to rear and outward flare from lip to arch allows load to drop quickly and easily from the bucket. Load dumps clear of high tubular arch.

LAST LONGER. Tapered design reduces loading and dumping friction to an absolute minimum. Bucket lasts longer. All welded construction and the maximum use of alloy steel castings makes a high strength-to-weight ratio resulting in "lower cost per yard operation".

Bring your bucket problems to *ESCO*, your bucket specialists. *ESCO* will "job-tailor" a bucket to your operation. Ask your nearest *ESCO* dealer for complete details, or write direct.

ESCO®

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Prospecting. The Universal 'Jeep' is a workhorse in all types of prospecting operations. It travels the highway in conventional 2-wheel drive at top legal speeds. Then, for rough going—through mud, sand, soft earth, over rocky terrain or up 65% grades—it shifts easily into 4-wheel drive for the all-wheel traction that takes men and equipment "anywhere-anytime."

'Jeep' vehicles GO where others can't to speed mining operations!

Mobile Power. With power take-off, the Universal 'Jeep' supplies mobile power to operate many types of special equipment from this mobile drill to winches or compressors.

New Forward Control 'Jeep' FC-150. This advanced 4-wheel drive truck puts a 74" pickup box on a wheelbase only 81" long. It's the first time a 4-wheel drive truck has combined so much cargo area with such unusual maneuverability.

'Jeep' vehicles get through when ordinary vehicles bog down in the heavy rough going of mining projects. Their rugged "go-anywhere" ability makes them ideal for use in every phase of the mining industry—from exploring or prospecting in remote areas to keeping maintenance work and service around the mine moving on schedule.

'Jeep' vehicles are the only 4-wheel drive vehicles in their weight class time-tested and performance-proved in billions of miles of transport service. They're the only vehicles originally designed and engineered completely for 4-wheel drive off-the-road use. They work for you 365 days a year. The extra traction of their 4-wheel drive takes them up steep inclines or over rocky ledges—anywhere you need to go! And they tow heavily-loaded ore trailers on or off the road—in good weather or bad.

Versatile 'Jeep' vehicles spread their costs over a wide variety of jobs...provide additional savings through long life, low upkeep and high resale value. Ask your Willys dealer for an on-the-job demonstration, or write for information.

The 'Jeep'®

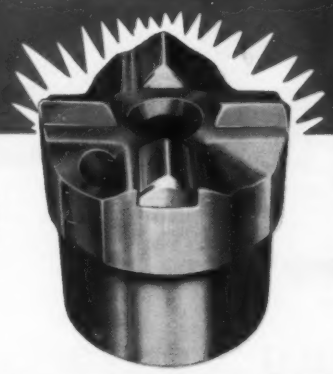
family of 4-Wheel-Drive vehicles

WILLYS...makers of time-tested utility vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

A TUNGSTEN CARBIDE INSERT BIT

"drilled to destruction without need of resharpening"



patents applied for

Lower first cost... Low cost per foot of hole drilled with

LIDDICOAT

the new bit you have heard and read about

Forged for Toughness

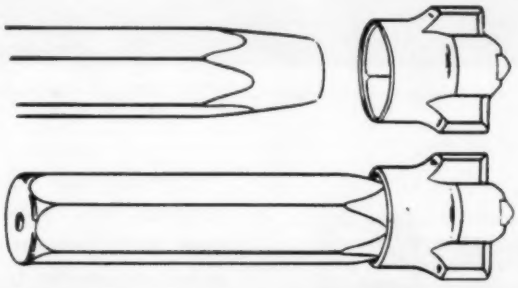
The Liddicoat Tee Cee bit body is produced entirely by forging. By a patented and exclusive manufacturing process, the hot alloy steel is subjected to tremendous pressure which extrudes the steel in the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the steel provides Liddicoat bits with an unusually strong tough body.

Longer Life from Interesting New Insert

In examining the Liddicoat Tee Cee bit, you will note the shallow tungsten carbide insert (patents applied for). It is the design of this insert that provides the unusual performance of the Tee Cee bit. Experience with the conventional multi-use insert bit indicates that the bit will usually dull at a given footage, the distance of course, depending on the type of rock. The dulling point of the multi-use carbide bit is not to be considered as the life of the Liddicoat single-use Tee Cee bit, for experience proves that the Liddicoat "used to destruction" Tee Cee bit drills far beyond the average dulling point of the multi-use Carbide bit.

Taper Socket—No Threads —Fast, Firm Attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal. The taper socket has been especially designed for the single pass Tee Cee bit.



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controlled metal hardness means

heat-treated cast alloy steel

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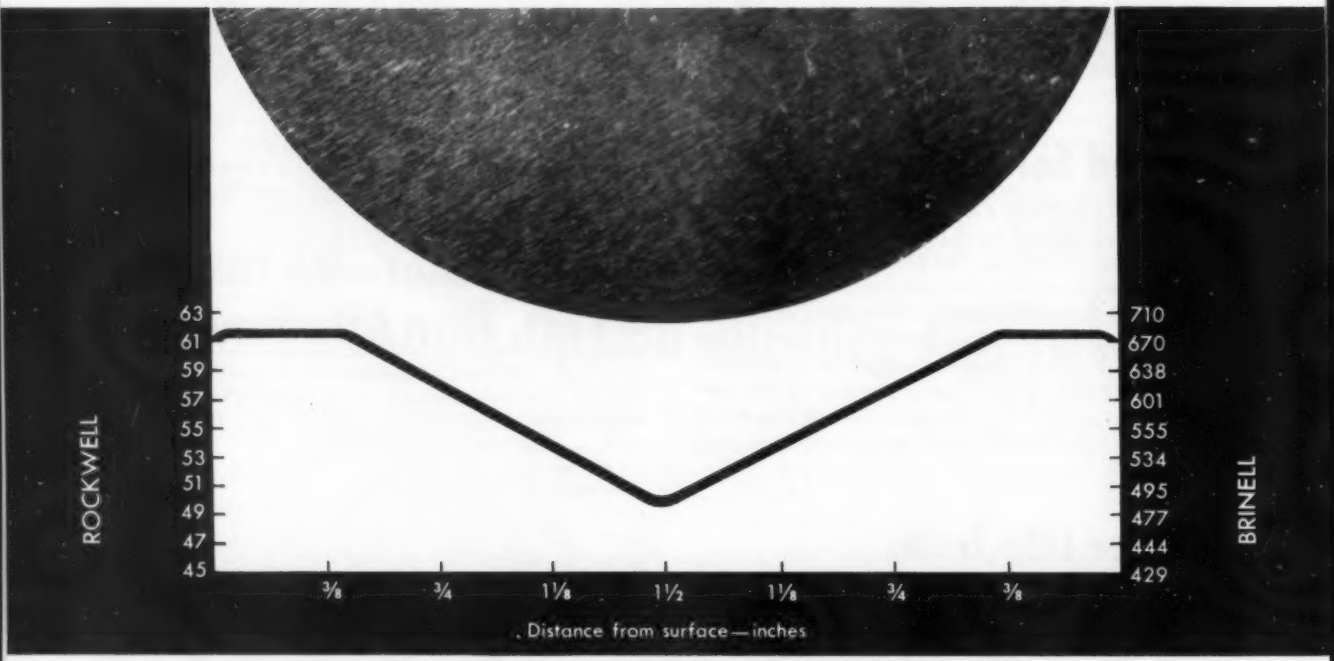
cut per-ton grinding costs



Note how new casting process and full heat treatment show controlled hardness between surface and inner core.

Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

AA-5059

CAPITOL FOUNDRY DIVISION

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

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Established 1868

DMEA Recaps Northwest Program Since 1951

The Defense Minerals Exploration Administration has certified 58 new ore-discoveries in Washington, Oregon, Idaho, and Montana since start of its Northwest program to stimulate exploration for strategic minerals six years ago.

Nineteen other projects not yet certified as discoveries are in production and paying royalties to the federal agency.

Value of ore shipped as a result of DMEA financial aid is many times the money spent in finding and developing the new deposits. Repayment royalties so far have been received on ore shipments valued at $6,623,705, compared to $5,575,000 dispensed by the DMEA in matching funds. Two firms have repaid all advances.

The DMEA has approved 191 exploration contracts in the four states since 1951. In 1956, nine were approved for total expenditures of $212,268. Three were for uranium, two each for lead-zinc and mercury, and one each for tungsten and monazite-thorium.

At year's end, 47 contracts were in effect calling for exploration expenditures of $8,187,400, of which the DMEA was to provide $4,238,000, repayable from royalties on production. Twenty-three were in Idaho, twelve in Montana, nine in Washington, and three in Oregon.

Sunshine Mining Company has opened good silver-lead ore at a depth of 3,850 feet in the Rotbart area of the "silver belt," Shoshone County, Idaho. The ore zone is believed to be the downward extension of a shoot found in 1956 on the higher 3700 level in the hanging wall of the Chester vein. The company also has had encouraging results recently in the Omega area along the Sunshine-Polaris vein system. Sunshine's 1956 ore production totaled 200,028 tons with a gross value of nearly $5,500,000.

The *Silver Mountain* deep development project east of Mullan, Shoshone County, Idaho, has been expanded to include 7,400 feet of additional tunneling at the 2,000-foot shaft level at an estimated cost of $381,842. This nearly doubles the original contract and boosts the total footage to 15,800 feet of crosscutting and drifting, and the total cost to $1,439,842. At last report, 100 feet of crosscutting had ben done from the shaft. *Hecla* and *Bunker Hill* mining companies are partners in the venture.

A north-south trending ore zone has been opened in ground of *Rainbow Mining and Milling Company* west of Wallace, Shoshone County, Idaho, by *Polaris Mining Company* in following an east-west fault-vein structure at a depth of 3,000 feet. At last report the shoot had been opened 145 feet and averaged 7 feet in width, carrying 33.2 ounces of silver and 0.7 percent copper to the ton. L. J. Randall, Wallace, is Polaris president.

Sidney Mining Company has pushed a deep exploration tunnel from the 2300 level of its lead-zinc mine in Shoshone County, Idaho's Pine Creek district several hundred feet into the adjoining property of *Nevada-Stewart Mining Company* on which Sidney holds a profit-sharing operating agreement. Principal objective of the drive from the 2,300-foot Sidney shaft level is the downward extension of ore drilled by the U.S. Bureau of Mines in 1943. Henry C. Smith of Spokane is president of Nevada-Stewart. Malcolm Brown of Kellogg heads Sidney.

Triumph Mining Company, operating the *Triumph* lead-zinc-silver mine near Sun Valley, Idaho, laid off about 50 percent of its working force on March 15th. More than 100 workers were told that the property would be shut down because continued operations were not profitable; production had not kept pace with cost of operation. Since March 15, operations have been on a clean-up, day-to-day basis. Upon completion of clean-up, operations will be suspended.

Eleven patented claims of the *Flynn* group near Gem, Shoshone County, Idaho, have been leased by *Black Bear Silver Lead Mines* for development from Black Bear workings. The Black Bear drift has already been extended into Flynn ground. *Metropolitan Mines Corporation* owns stock control of the Black Bear firm, which has been producing ore on a small scale and putting it through the Hull Lease mill. The mill is now running steadily one shift per day on Black Bear ore.

Golden Crest Mining and Milling Company of Boise, Idaho has been incorporated by Joseph Pick, George Jensik and Ben Pintacura, all of Chicago. The firm was capitalized at $1,000,000.

Cordero Mining Company is undertaking a $28,572 tungsten exploration project at the *White Horse* mine in Custer County, Idaho. The Defense Minerals Exploration Administration has a 75 percent participation. J. Eldon Gilbert of Palo Alto, California is company manager.

Construction of a $45,000,000 alumina reduction plant at Moscow, Idaho, is being considered by *The Anaconda Company*. Construction will depend upon success of a $1,000,000 pilot plant scheduled to go into operation next October. Alumina would be obtained from Latah County clays.

Oom Paul Consolidated Mining Company is planning a geological examination of old underground workings at its 10-claim property 1½ miles northeast of Burke, Shoshone County, Idaho. The ground has lain idle for many years. L. S. Eddins, Wallace, is treasurer.

Miners exploring a new lead-zinc ore body in the old *Morning* mine at Mullan, Shoshone County, Idaho had opened the ore zone for a distance of 230 feet at last report and the structure was continuing strong. The shoot is in the Noonday vein which parallels the largely worked-out Morning vein. J. C. Kieffer is manager of *American Smelting and Refining Company's* Northwest mining department, which is operating the mine.

J. A. Terteling and Sons was successful bidder at $183,994 for a lease on 1,638 acres of state-owned phosphate land in Caribou County, Idaho.

Husky Oil Company of Cody, Wyoming got a 1,249-acre tract for $17,061.

Abot Mining Company, which was recently incorporated at Wallace, Idaho, has offered to purchase the properties of *Pilot Silver-Lead Mines, Inc.*, northeast of Mullan, Idaho, including the *Cincinnati* lease. Directors of Pilot have accepted the offer and a meeting of stockholders is scheduled for early May to vote on the action. Henry L. Day, president of *Day Mines, Inc.*, also heads the Abot group.

Golconda Lead Mines' custom concentrator east of Wallace, Shoshone County, Idaho, has been operating seven days a week on ore from the *Lucky Friday* mine near Mullan. Golconda mine production varies from 25 to 30 tons of lead-zinc-silver ore daily. John A. Featherstone, Wallace, has succeeded his father, the late Judge A. H. Featherstone, as president and general manager. H. F. Magnuson of Wallace was advanced from secretary to vice president.

The *Ruby Company*, Boise, Idaho, has taken a lease on 2,900 acres of state-owned land in Latah County, Idaho for placer mining of clay. The Idaho State Land Board also approved a 236-acre quartz lease in Shoshone County to Richard J. Hansen of Coeur d'Alene.

Central Farmers Fertilizer Cooperative of Chicago at last report was going ahead with preliminary work for construction of a $10,000,000 phosphate plant at Georgetown Canyon, Bear Lake County, Idaho, despite lawsuits filed by *Monsanto Chemical Company* which operates a phosphate plant at nearby Soda Springs. Crews were constructing an access road and railroad grade, and stripping overburden in preparation for an open-pit operation of about 1,500 tons daily. Joseph L. Lanter is president of the cooperative.

Salmon River Scheelite Corporation is planning to buy a rod-mill regrind circuit and electromagnetic separator for its tungsten upgrading refinery at Salmon, Lemhi County, Idaho. Government-grade (60 percent WO_3) concentrates are expected to result. A 48-ton carload of 23 percent WO_3 concentrates was shipped to *Wah Chang Smelting and Refining Company* last fall. Discontinuance of tungsten purchases by the General Services Administration pending new congressional appropriations held up complete payment and forced the company to authorize sale of remaining treasury stock (738,500 shares at 20¢ each) to provide additional working capital.

West Star Mining Company is installing a larger air compressor to facilitate exploration and development work at its holdings east of Gem, Idaho in Shoshone County's Coeur d'Alene mining district. A three-man crew has been tunneling toward the anticipated downward extension of surface ore. Alexander Markwell of Spokane is firm manager.

The *Anaconda Company* has ceased copper production in the *Belmont* mine at Butte, Montana, representing approximately 600 tons per month, and the company is in the process of gradually suspending production at the *Mountain Consolidated* mine which is currently producing 1,400 tons per month. The firm believes that it can more profitably employ available manpower in development

6 VACSEAL PUMPS have met the acid test!

Pictured above is a shipment of VACSEAL Pumps, part of a consignment to a large Canadian ore processing mill, where large-scale operation in the acid circuit has decisively proved that VACSEAL is the economical answer to their pumping problem. VACSEAL was chosen basically for its unique "vacuum" design, its proven capacity for handling acids, slurries, and suspensions without gland water dilution. VACSEAL excels in the handling of valuable materials where slurry dilution and liquid losses must be avoided.

Materials being pumped by VACSEAL do not come in contact with the shaft or shaft sleeve when in operation. Wear of vital parts is thus reduced to a minimum. VACSEAL'S semi-open impellers give further assurance of long, trouble-free operation.

VACSEAL Pumps are manufactured in six sizes, capacities ranging from less than 20 to over 3,000 gpm. Pumps made acid-proof at low additional cost. Both rubber-lined types and alloy models are available. Any special information you require will be cheerfully supplied. Galigher has the answer to your "pump" problem.

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GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication.

work for the future when copper prices will again be attractive for such high cost properties than to maintain production on present price levels.

Preparations are being made for resumption of operations in the open-pit phosphate mine of *Montana Phosphate Products Company* near Garrison, Montana, after suspension for the winter months. *Utah Construction Company* is doing the stripping and mining for the firm.

W. L. Echols and N. F. Collier are installing a headframe, repairing 120 feet of the present winze, and sinking an additional 50 feet to the 170 level under a substantial manganese exploration contract. The contract also calls for 350 feet of crosscutting. The work is being done in the *Whitehorse* mine, a mile east of Philipsburg, Granite County, Montana.

Holliday Mines is readying its *Pilgrim Creek* property near Noxon, Montana for production. Minerals are galena, sphalerite, chalcopyrite, and silver. Mark Holliday of Noxon heads the firm.

The Defense Minerals Exploration Administration has approved a $21,580 manganese exploration project by *Pioneer Corporation* of Idaho at the *Arrowhead* lease in Missoula County, 30 miles east of Missoula, Montana. Underground drifting and diamond drilling are planned. The property was operated as an open-pit last year under lease from *The Anaconda Company*. J. S. Barrett of Buffalo, New York is managing director, and Robert G. Ferris of Spokane is vice president.

Expenditure of at least $10,000 in exploration and development at the *Lucky Joe* uranium prospect on the West Fork of the Bitterroot River, Ravalli County, Montana, is planned this year by *Hypotheek Mining and Milling Company* and *National Uranium Corporation*, both of Wallace, Idaho. Both tunnel work and diamond drilling are planned.

The *Montana Bureau of Mines and Geology* has published a new booklet entitled, "Operating Ideas for Small Mines," by Koehler Stout. The booklet contains suggestions and operating procedures for prospectors and developers of small mines. Copies may be obtained at $1.00 each from the Montana Bureau of Mines and Geology at Butte, Montana.

OREGON

Plant operations are running smoothly at *Hanna Coal & Ore Corporation's* Riddle, Oregon project where the installation of dust collectors on the No. 1 furnace has been completed.

Operations were temporarily interrupted at the *White King* uranium mine of the *Lakeview Mining Company* in Lake County, Oregon when a fire destroyed two generators and a large air compressor. Damage was estimated at between $30,000 and $35,000.

The *U.S. Forest Service* has notified (by local newspaper) mining claimants in several areas of Oregon that land determinations will be made in those districts. These areas are: Fuller and Wildhorse in Siskiyou National Forest; Little North Fork in Willamette National Forest;

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T-1
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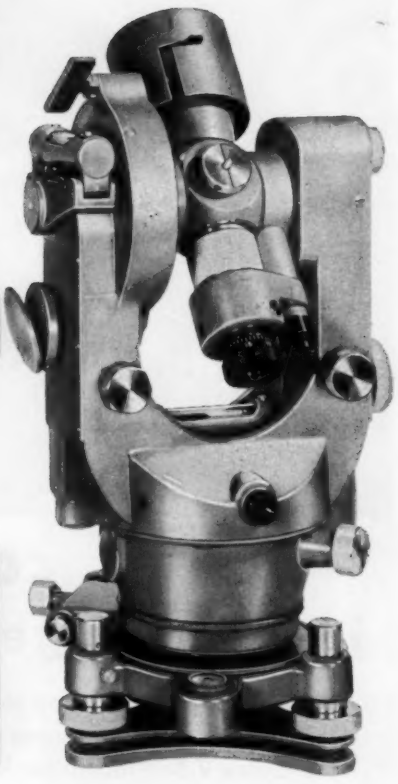

By day or underground, this WILD *instrument offers unprecedented advantages*

From its optical excellence to its mechanical precision the T-1 has earned a world-wide reputation for great performance. Users everywhere praise the instrument for its rapid set-up, high accuracy and virtually unlimited versatility!

NOTABLE FEATURES OF THE WILD T-1

- Reads direct to 20 seconds with interpolation to 10 seconds, on both horizontal and vertical scales.
- More than a dozen accessories are available for quick, simple, accurate solution of routine and special problems.
- Built-in illumination for both circles, scale and reticle.
- Rugged, precision construction throughout.

PRICE: $718; F.O.B. Port Washington, N. Y. Tripods extra. Write for Booklet T-1.

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Why concave sides insure longer V-Belt life

With one simple test you can demonstrate to yourself why the concave sides (Fig. 1) of the Gates V-Belt insure far longer belt life.

Just feel the sides of a Gates V-Belt on the bend. Note that in bending around the sheave these sides fill out and become straight (Fig. 1-A). That means the belt makes full contact with the sides of the sheave groove; grips the sheave *evenly*.

This even contact distributes wear uniformly across the sides of the belt. Uniform wear lengthens belt life; keeps costs down.

Fig. 2

Now make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating wear at the points shown by arrows. Uneven wear shortens belt life; increases belt costs.

Cut V-belt replacement costs and down time. Specify belts that grip evenly and wear longer . . . specify Gates Vulco Rope — the V-Belt with concave sides.

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World's Largest Maker of V-Belts

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 150

Gates Vulco Rope Drives

NORTHWEST

Chemult in Deschutes and Fremont National Forests; and Woodley, Dooley Mountain, and Buffalo in Whitman National Forest. A "verified statement" must be filed within 150 days with the Land Office of the Bureau of Land Management, P.O. Box 3861, Portland 8, Oregon. The statement must be sworn before a notary public or other officer authorized by law to administer the oath. A "verified statement" form can be obtained by writing to offices of the Oregon State Department of Geology and Mineral Industries.

Sierra Land Company, Grants Pass, Oregon has purchased the old *China* placer on Palmer Creek in Jackson County. Operators Frank M. Kolkow and Ben R. Haynes have been using a 10-inch Diesel pump and No. 2 giant. Howard Lewis, Grants Pass, is one of the owners.

WASHINGTON

A zinc-lead exploratory drilling program at the *Scandia* mine in northern Stevens County, Washington, is planned for this summer by *Grandview Mines* of Spokane. Articles of incorporation have been amended to double capital stock and put the firm in position to expand its activities. Karl W. Jasper is president.

Dawn Mining Company, subsidiary of *Newmont Mining Corporation* and *Midnite Mines, Inc.*, has awarded a contract to *Beardmore Transfer Line*, to truck 160,000 tons of uranium ore annually from the *Midnite* mine in the Spokane Indian Reservation to Dawn's $3,000,000 uranium processing plant at Ford, Washington. Ore will be stockpiled until the plant goes into operation this summer. Dawn also has awarded *Potlatch Yards, Inc.* a contract to build 12 staff houses adjacent to the plant. R. B. Fulton of Spokane is general manager.

Highnoon Uranium Mines is planning a stockpiling program at its autunite property on Lost Creek, Pend Oreille County, Washington, at the recommendation of J. Fred Williams Jr. of Pullman, Washington, consulting engineer. C. N. McJunkin, Hermiston, Oregon, is president, and Charles A. Pulford, Newport, secretary-treasurer.

Northwest Refining and Chemical Company has completed testing a reverbatory furnace and other equipment at its new $260,000 Spokane Valley plant in Washington, and has started production of ammoniated zinc sulphate fertilizer and zinc oxide. Barnard Wilcox, former Wallace, Idaho metallurgist, is in charge of production and research. John A. Allen of Opportunity is secretary.

Lead Trust Mines, Inc. has completed preliminary prospecting of more than 5,000 acres of state mineral leases in northeastern Washington, and is planning exploration of about 1,000 acres on which leases have been renewed. The retained lands are in southwestern Stevens County and in southern Pend Oreille County adjoining Spokane County on the north. Opening of a second tunnel at a copper prospect near Chewelah, Stevens County, also is planned this season. A mile of road was built last year and a tunnel opened. F. J. Cardinal, Spokane, is president and manager.

Development of shipping-grade copper-zinc-lead-silver ore at the *Dutch Miller* property at the head of the Middle Fork of the Snoqualmie River, King County, Washington, is planned this spring by *Cougar Development Corporation* of Calgary, Alberta, Canada. Limited surface work has indicated the ore occurs along a joint plane in granodiorite. W. G. McLeod examined the property for the company.

Five Spokane men have formed *Mudhole Exploration, Inc.* to do additional uranium prospecting on leases in northern Spokane County and in Pend Oreille County. Initial test holes in a muddy area along a stream showed some mineralization. Frank H. Duval is president and Duane Watters, secretary-treasurer.

Painted Desert Uranium and Oil Company of Spokane at last report was preparing a new public stock offering to finance additional exploration work at uranium leases in Spokane and Stevens County, Washington, and in Utah, and development of a recently acquired tungsten property southeast of Beauty Bay, Lake Coeur d'Alene, Idaho. William M. Fredericks is secretary-treasurer.

A 340-acre property in southern Asotin County, Washington, has been purchased by the *Ideal Cement Company* of Denver, Colorado from Doris Watson of Kooskia, Idaho for $10,000. Lime deposits have been known in the area for years.

North Star Uranium, Inc., at last report, was waiting for weather and road conditions to improve sufficiently to permit resumption of autunite shipments from its *W. E. Lehmbecker* lease in the Mount Spokane district, northern Spokane County, Washington. Two cars were shipped to a Salt Lake City processing plant before a severe cold wave forced suspension of operations. Sam W. Farber, Spokane is secretary-treasurer.

Additional development work is planned by *M.P.C. Mining Company* on a 40-claim uranium prospect staked in 1955 on Mount Leona, Ferry County, Washington. Work has included 8 miles of Jeep road, 2,500 feet of wagon drilling, and excavation of five outcroppings. Some 100 tons of ore has been stockpiled. Autunite, uraninite, and uranophane minerals have been identified. The firm is owned by J. D. Morse and Forrest W. Morse of Lebanon, Oregon, William F. Morse, Harrisburg, Oregon, and Warren Price and Duane Crowe, Springfield, Oregon.

A new firm, *Kelly-Tedrow Company*, has entered into a long-term lease-purchase contract with *U. S. Gypsum Company* for lime rock stockpiled at the latter's Evans, Washington operation in northern Stevens County. Equipment has been installed for crushing the rock to a one-quarter inch minus screen and the crushing contract awarded to Neil Greeson, Cut Bank, Montana. *Yeator Transport Company* of Greenacres, Washington has been given a contract to truck the crushed material 44 miles to the *Consolidated Mining and Smelting Company of Canada, Ltd.* at Trail, British Columbia for use as flux in smelting operations. Owners of the new firm are Ray R. Kelly, Tacoma general contractor, and Cline E. Tedrow, Spokane consulting mining engineer.

Ore, Inc. of Spokane, Washington has been organized by Gordon Berkhaug, James L. and James A. Canwell and L. L. Lorang to deal in ore specimens and in mine advertising.

Interior of a Hardinge 11½′ x 12′ Rod Mill with 85-ton rod load, 1000 horsepower.

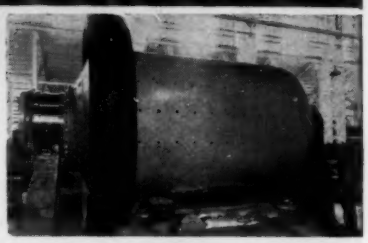
Hardinge
ROD MILLS

Sizes range from 2′ to 11½′ shell diameter and up to 1000 horsepower.

Types include trunnion overflow and peripheral discharge for both wet and dry grinding.

Applications include both open and closed circuit arrangements for ores, aggregates, concrete sand, cokes, and abrasives.

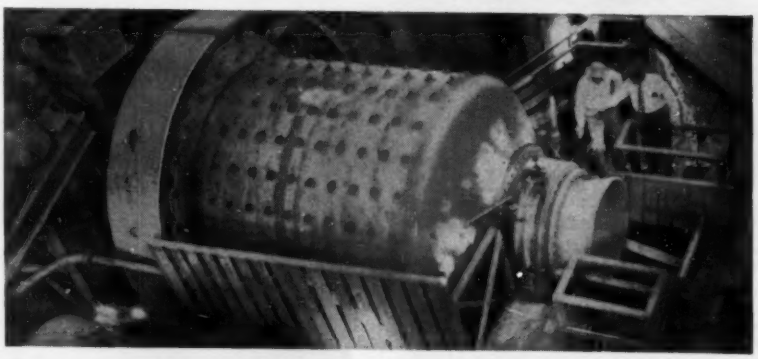
Complete specifications on request. Bulletin 25-C-3.



Trunnion overflow mill

End peripheral discharge mill

Center peripheral discharge mill



Exterior of 11½′ x 12′ Hardinge Rod Mill shown above

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Large mill hammers taken from the scrap pile needed a 2" to 2¼" build-up on length... required approximately 5 lbs. of Manganese and Stoody 100, combined. Smaller amounts of build-up and hard metal are required for subsequent maintenance.

DON'T THROW AWAY 9/10 OF EVERY MILL HAMMER

The Victorville Lime Rock Company on the Mojave Desert some 75 miles from Los Angeles operates a plant for the reduction of high grade limestone that is processed for a great many uses, from face powder base to roofing materials. For intermediate crushing the company uses Williams hammer mills —and as usual, hammer maintenance is a problem.

When a Stoody representative first called at this plant he found a scrap pile of worn hammers that had been discarded in favor of standard replacements. 9/10 of the hammer was still there but so severely worn as to have lost its efficiency. A set of nine new hammers represents an investment of approximately $200.00, so the huge scrap pile, to the hard-facing specialist, had all the appearance of a gold mine.

Tests were undertaken to determine the cost of rebuilding such hammers; a copper form was clamped around the worn end to fix the shape and the finish length. Using the semi-automatic welder running Stoody Nickel Manganese, the hammer was brought back to just under finish size, then peened and hard-faced on the end and corners with Stoody 100.

The original experimental rebuilding job proved successful and the procedure outlined has now been established as routine. New hammers measuring 4"x5"x10½" weigh 45 pounds. Between four and five pounds of Manganese and Stoody 100, a high-alloy, wear-resistant material, are required to bring a worn hammer back to size. The semi-automatic welding procedure is extremely fast, depositing three to six times as much weld metal as is possible by the manual method. After rebuilding, each hammer is carefully weighed and balanced for proper operation of the mill. As wear occurs in service, the semi-automatic welder is used to apply additional Stoody 100 free hand to maintain hammer size and shape.

By the method described hammer costs are enormously reduced and the mill's performance is considerably improved.

Further information on the hard-facing of all types of crushing equipment is provided by various pieces of Stoody literature. See your Stoody dealer (you will find him in the "Yellow Pages" of your phone book) or write direct.

George Stone, Maintenance Superintendent, shows turn-table fixture which speeds welding. Forms surrounding hammers are copper, establish hammer size and height of build-up.

Other hard-facing includes these quarry shovel teeth. Points are rebuilt with Stoody Manganese and hard-faced with Stoody 100. Note the copper mold which shapes the point.

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COLORADO

During 1956 the mine and mill of Climax Molybdenum Company at Climax, Colorado produced and treated 9,930,000 tons of ore, representing the greatest production in the history of the mine. Average daily production for the year was about 32,000 tons, and at year-end the average had been increased to 34,000 tons daily. However, actual production of molybdenum decreased from 43,043,138 pounds to 37,489,000 pounds because it was necessary to mine lower grade ores. A new mine level is being developed and should be ready for production in eight years, by which time the upper of the two levels now being mined is expected to be exhausted. The company has increased exploration drilling of areas immediately adjacent to the mine.

Continental Oil Company has an exploration option on a uranium prospect in northwestern Grand County, Colorado, and will undertake a $50,000 drilling program this season. The property was optioned from Voss Oil of Newcastle, Wyoming. Cog Minerals holds a 50 percent interest in the prospect.

Southwest Exploration and Development Company reports it has located uranium near Craig, Colorado where it has been prospecting since 1955. Initial shipments have been made to the Carbide Nuclear uranium mill at Rifle. The property, called the *Doc Armour*, is being strip mined, thus far only to 24 feet in depth. The ore is described as a soft carnotite, probably from the Wasatch formation. Continued drilling is planned this summer.

Shattuck Denn Mining Corporation produced 46,292 pounds of uranium and 247,078 pounds of vanadium from its Uravan, Colorado property in 1956. The property is operated under lease from the United States Atomic Energy Commission. Production is continuing on a reduced scale pending development of additional ore bodies recently encountered. A second shaft has been sunk to provide ventilation and access. Drilling will be done from the surface to test favorable ground located a considerable distance from the present underground workings.

The *Empire Zinc Division* of the *New Jersey Zinc Company* continued to produce zinc ore, and some copper-silver ore from the Gilman, Colorado operation during 1956. Development on the lower levels of the mine continued throughout the year with encouraging results. The Canon City plant operated at full roasting capacity during the year.

Front Range Mines of Denver, Colorado plans to sink a 200-foot development shaft on its uranium property in Moffat County, Colorado. Drill holes indicated an ore deposit similar to that blocked out by *Trace Elements* on its adjoining propetry.

New Verde Mines Company, a wholly owned subsidiary of *Empire Star Mines Company, Ltd.*, has leased a small producing mine on Calamity Mesa, 65 miles southeast of Grand Junction, Colorado. The main adit was advanced an additional 869 feet last year, and 2,314 tons of ore were mined after production started in April 1956. Production will continue on a limited scale until the adit is driven another 900 feet to its goal of 2,500 feet.

"Petroleum Information" published in Denver, Colorado has placed its Uranium Information bulletin on a bi-weekly basis instead of weekly because it has become apparent a full weekly news service is not essential.

Lost Creek Oil & Uranium Company of Rawlins, Wyoming has changed its name to *Western Nuclear Corporation* and has opened offices in Denver, Colorado. Colonel W. W. Fertig is in charge of the Denver branch, with Ed Bitzer as consulting metallurgical engineer.

The AEC has released 95,216 acres of public land and 3,760 acres of reserved minerals in privately owned lands in Montrose and San Miguel Counties, Colorado which it had previously withdrawn. These lands have now been restored to location of unpatented mining claims. They will not be open to claim location, however, until 10 a.m. on July 20, 1957.

Climax Molybdenum Company will start to sink a 600-foot development winze early this fall from the Storke underground workings at Climax, Colorado. Since the Storke is at the 300-foot level, the new shaft will actually bottom at 900 feet from the Philipson Level which is above the Storke. Preliminary exploration work indicated that the shaft will be sunk in the waste core in the 3160 section. When developed, it is expected that the 600-foot level will approximate the Storke Level in size and tonnage. Some exploratory drifting and diamond drilling will be done on the 900-foot level.

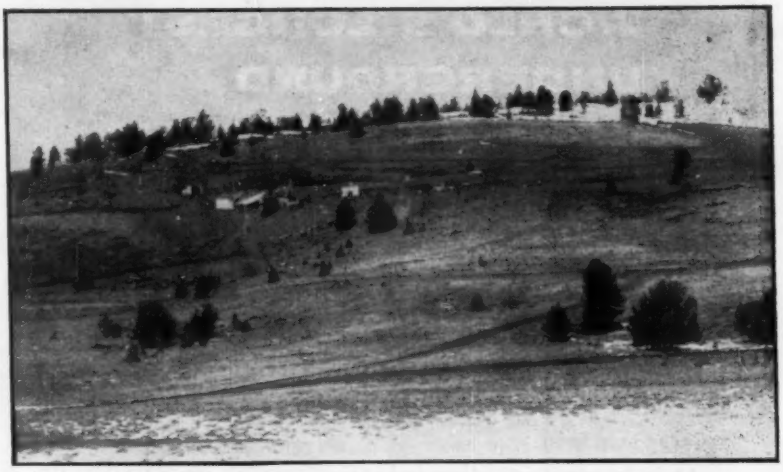
NORTH DAKOTA

Juniper Oil and Mining Company reports it has taken over about 8,000 leased acres near Dickinson, Billings County, North Dakota, which cover uranium-bearing lignite.

SOUTH DAKOTA

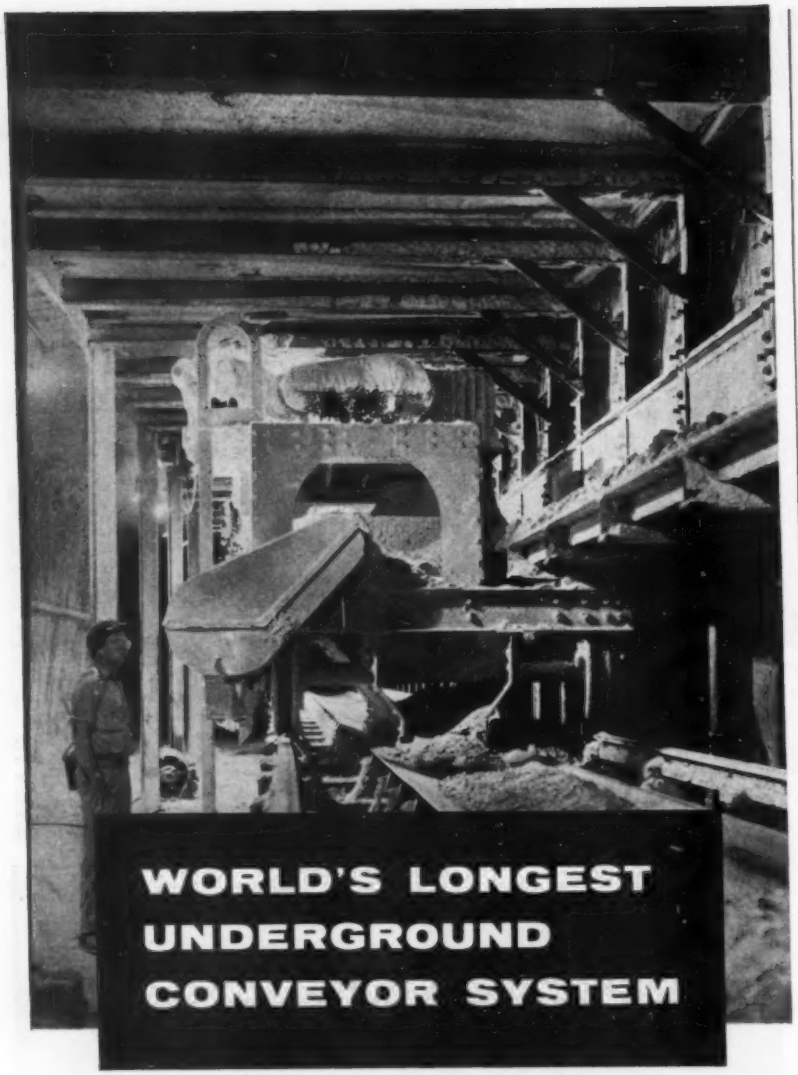
By the end of 1957, *Homestake Mining Company* expects both the Main Ledge and 9 Ledge potentials from 5000 to 5600 levels to be known in its gold mine at Lead, South Dakota. Last year the deep level program reached the point of starting crosscutting from the No. 4 winze on both the 5300 and 5600 levels. Tons milled in 1956 were 1,627,719, an increase of 77,603 tons over 1955. The fourth ball mill went into operation in February 1956 and it made possible the treatment of this additional ore.

Edgemont Mining and Uranium Company which was acquired by *Giant Resources Inc.* as of February 1, 1957, produced about 22,000 tons from its underground uranium operations near Edgemont, South Dakota last year. Most of



U.S. Steel Explores Wyoming Iron Prospect

A long distance view of Columbia-Geneva Division, United States Steel Corporation's Atlantic City project near Lander, Wyoming is shown above. The 700-foot exploratory adit being driven into the main hill at the iron ore prospect is about completed. The work was done, under contract, by Centennial Development Company of Eureka, Utah to obtain bulk samples for testing, and to verify results achieved through drilling. Additional test work is planned by Columbia-Geneva during the remainder of the year. Results will then be presented to U.S. Steel, accompanied by a request for funds and approval to proceed with development of the project. If approved, construction of crushing and beneficiating facilities and a 50-mile railroad spur to the main line of the Union Pacific Railroad will be the major items. If the development phase is undertaken, the mine will provide an additional source of supply for the Geneva Works plant near Provo, Utah. The project would be the highest, large-scale mining operation in the United States, since it is located at 8,300 feet above sea level, near the point where the historic Oregon Trail crossed the Continental Divide. The company has also purchased an option on seven placer claims containing 1,120 acres immediately to the west of its main holdings. The claims are owned by Wyoming Mica and Metals Corporation. The option extends to August 1958.



This rotary plow feeder is part of a 45-unit, 7½ mile Hewitt-Robins belt conveyor system located 1000 feet underground in Carlsbad, N. M. The system is designed to carry up to 550 tons of potash ore per hour from mining areas to a storage pit. Here the H-R rotary plow feeder scoops ore onto another conveyor for its trip to the refinery skip hoist.

As in hundreds of other industrial installations, this Hewitt-Robins belt conveyor system effects a material saving in handling costs. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut.

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this ore, 17,000 tons, came from the *Gould* mine which had only produced about 5,000 tons in the previous year.

Triangle Enterprises Inc. of Edgemont, South Dakota has filed for incorporation to explore and develop mining properties. Applicants for the charter were A. Ludwig, E. J. Brockman, and L. W. Bischoff, all of Edgemont.

UTAH

A fairly substantial tonnage of better-than-average grade uranium ore has been developed by underground tunneling and surface drilling at the *Ransom* uranium mine near Blanding, Utah. *Sunshine Mining Company* is the operating firm.

Recent reports indicate that *Atlas Corporation* which bought the fabulous Vernon Pick uranium mine near Moab, Utah in 1954 for $9,000,000 may close the mine in June. At the time of its purchase the *Delta* mine was estimated to contain 300,000 tons valued at $12,000,000. Later the reserve was re-estimated at 600,000 tons, worth $25,000,000. The Atlas annual report reveals that the Delta produced only 100,000 worth about $2,000,000, and its reserves are only valued at $160,000. Apparently Atlas will write down the value of the mine by $9,131,268.

Cog Minerals Corporation, a wholly owned subsidiary of *Colorado Oil and Gas Corporation*, reports that it has developed a process for upgrading uranium ores of the White Canyon, Utah area. The process will soon be tested in a 75-ton pilot concentrator mill. The company is developing the *Spook* and *Bullseye* claims in that district which it acquired from *Midwest Consolidated Uranium Corporation* when it purchased all the assets of the latter firm in May 1956. By year end, the mines had produced and sold 3,000 tons of ore per month.

The *Vanadium Corporation of America* has leased 42 mining claims covering 850 acres in the Marysvale area of Utah. The land is east of properties now operated by the company.

The *Little Beaver* uranium property operated by the *Homestake Mining Company* in the Big Indian district of Utah is expected to be mined out by June and the operation shut down. Total production from the property through December 1956 amounted to 50,236 tons of ore with an average grade of 0.40 percent U_3O_8, of which 30,356 tons at 0.41 percent were mined in 1956. In the *La Sal* mine also operated in the same area by Homestake, about a quarter of the known ore body has been mined. This property has yielded 83,703 tons at 0.42 percent U_3O_8; 61,734 tons of this at 0.37 percent were mined in 1956.

Extensive drilling of the *Hot Rock* claims in the Big Indian District of Utah by *Hecla Mining Company* of Wallace, Idaho, has indicated 31,210 tons of ore assaying 0.40 percent uranium oxide. The ore will be mined by Hecla through the Radon mine shaft which it put down for *Radorock Resources, Inc.*, subsidiary of *Federal Uranium*. Hecla's production from the Radon mine in 1956 totaled

53,605 tons assaying 0.438 percent uranium oxide.

The *United States Smelting Refining and Mining Company* is sinking a winze to explore deeper sections of the U.S. Section of its *U.S. and Lark* mine in Tooele County, Utah. Also on the program has been sinking of an inclined shaft preparatory to opening two new and deeper operating levels in the Lark Section. The mine operated on an alternate five- and six-day week basis with two shifts per day throughout last year. Grade of ore produced was about the same but tonnage was somewhat higher than in 1955. Development work in the lower Bingham area, extending into new property acquired under lease last year, is continuing along with other development projects.

Kennecott Copper Corporation's Utah Copper Division has inaugurated a new route for disposal of mine waste from the *Bingham* open pit. Waste trains are now traveling through the 5840 tunnel to a new dump, the 5816 dump, located just below the Central Yards in lower Bingham. Previously nothing but ore had been uncovered at levels low enough to be hauled through the lower tunnel. Waste is now being stupped from lower elevations in the mine as the pit expands around the ore body, and necessitates continued efficiency in all of the division's operations if production of copper from the low-grade ore is to continue profitably.

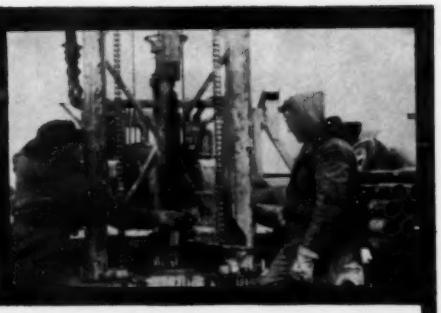
Pleasant Valley Oil & Mining Company of Salt Lake City, Utah plans to undertake additional exploration and development work on its uranium claims near Granite Mountain, Juab County, Utah in the spring. Some development work was done in 1955 with a trial shipment sent to the processing mill in Salt Lake.

WYOMING

Radorock Resources Inc. of Salt Lake City is reported to have made agreements with two companies which will call for exploration and development of more than 800 uranium claims in Wyoming by Radorock. The first involved are *Amrad Oil and Minerals Corporation*, with 300 claims in the Gas Hills area, and *Gas Hills Uranium Company*, with more than 500 claims in the Gas Hills and Crooks Gap areas. This is a profit-sharing agreement and both firms will share in any net profits from their properties. A comprehensive drilling program is underway with funds advanced by Radorock. The latter is a subsidiary of *Federal Uranium Company* which owns 52 percent of the stock.

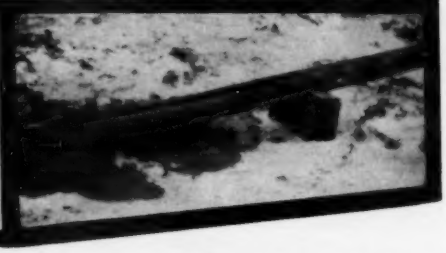
Construction has started on the $7,000,000 uranium mill in the Gas Hills district of Wyoming which will be erected by *Lucky Mc Uranium Corporation*. Capacity of the 750-ton-per-day installation is expected to be increased while under construction. Unofficial figures indicate that the Lucky Mc ore body contains between 1,200,000 and 2,000,000 tons of ore; reserves have been increased by recent drilling. Utah Construction Company, which owns a 60 percent in Lucky Mc, has started stripping of the nearly 2,000,000 cubic yards of overburden from two of the main ore bodies. No

Cooperation between manufacturer and operator gives . . .

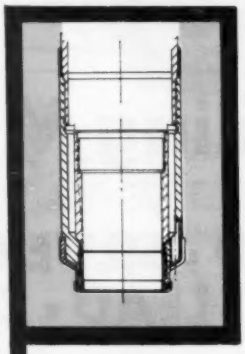


96.7% CORE RECOVERY

IN POORLY CONSOLIDATED FORMATIONS



Equipment Engineered for the Job



Core recovery in the Gas Hills of Southwestern Wyoming was only 40 to 60 percent, proving a major problem to drillers. This very low return was first attributed to the failure of core catching devices to hold core in the inner tube. After considerable trial and error with every type of core catching equipment the Christensen engineer became convinced that the circulation fluid was actually washing away the friable and poorly consolidated uranium bearing sediments before they entered the inner tube.

With all the facts and actual job experience, Christensen then adapted the 4½" x 3" core barrel for use with a long nose or pilot type diamond set core bit. This allowed the driller to actually core *ahead* of circulation.

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mining is to be done until the mill is completed, however. A reorganization of Lucky Mc has brought the election of Allen D. Christensen as president of Lucky Mc. He also heads Utah Construction. W. H. H. Cranmer, former president of the firm, is vice president and a member of the board of directors. Riverton, Wyoming was designated as the main office for Lucky Mc.

The Wyoming Supreme Court has ruled that a mining district cannot require assignment of royalties and/or a share of proceeds from future sales for claims located within its boundaries, or even require that claims have to be filed with it. The court ruled that filing of the required location notice with the county clerk is all that is required. The ruling, in effect, sounded the death knell for the Pumpkin Buttes mining district which had been organized at the time the withdrawn area was opened for mineral location.

Ten Gas Hills producers are currently delivering uranium ore to the AEC buying station located at the site of the *Western Nuclear Corporation's* processing mill under construction at Split Rock in the Sweetwater area of central Wyoming, where the ore will subsequently be milled. The shippers are *Vitro Minerals, Two States Mining Company, Gas Hills Uranium Company.* Ray A. House, Harold Reach, *Valley Dean Corporation, Aljob Mining Company,* Dale B. Levi, *Globe Mining Company* and *Veca Minerals.*

Utah Construction Company of San Francisco has paid an undisclosed amount for a 7½ percent interest in four *Broadway* claims in the Gas Hills area of central Wyoming. The interest was purchased from Sam Day, Fort Collins, Colorado uranium and oil man. The claims are located about 3 miles south of the *Lucky Mc Uranium Corporation's* mill location in which Utah Construction has a 60 percent interest.

A loan of $4,773,500 to continue financing of its uranium mill and town near Split Rock, Wyoming has been obtained by *Western Nuclear Corporation,* formerly *Lost Creek Oil & Uranium Company,* of Rawlins, Wyoming, according to president R. W. Adams. The money was loaned by banks in Denver, Cheyenne, Chicago, and New York City.

AEC approval for two more uranium mills in the Gas Hills area of central Wyoming is being sought by two mining companies. They are *Globe Mining Company* of Casper, Wyoming and *Giant Resources, Inc.* of Grand Junction, Colorado. Globe has proven reserves of more than 400,000 tons in the Gas Hills. Giant is negotiating with several holders of proven reserves. According to company officials it is contemplated that the majority of the capacity of this mill be dedicated to custom ore, which will give the independents in the area a greater possibility of sale for their production.

Contemplated construction of an aluminum reduction plant at Lake DeSmet near Buffalo, Wyoming is expected to be indefinitely postponed by *Reynolds Metals Company* as a result of a power decision in New York. Governor Harriman approved a controversial contract for sale of St. Lawrence power to Reynolds for a proposed $88,000,000 plant at Rooseveltown, New York. If construction of the plant goes ahead, the Wyoming project will likely be postponed indefinitely.

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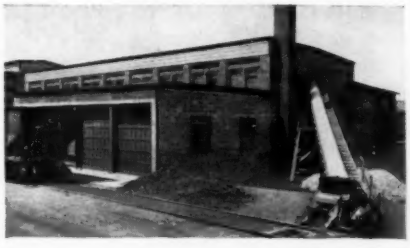

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Phelps Dodge Makes Second Production Cut; Attempts To Equalize Copper Supply and Demand

Phelps Dodge Corporation has put into effect a second cut in production in an effort to keep copper supply and demand in balance. The present cut follows a 6⅔ percent curtailment made last November. The combined effect of the two cutbacks amounts to a reduction of approximately 2,250 tons of copper per month, or 10 percent of the corporation's total output. According to the company's western division office in Douglas, Arizona, the reduction will be made by revising the schedule of open-pit mining and milling operations so that there will be 23 operating days instead of 24 days out of each four-week period. The November cutback reduced the operating schedule to 24 days out of 28 from 26 days out of 28.

The Morenci Branch of Phelps Dodge at Morenci, Arizona, removed from its open-pit mine in 1956 a total of 54,582,550 tons of material, an average of 170,039 tons per working day. The ratio of waste and leach material to ore was 2.25, compared with 2.08 in 1955, or 16,794,287 tons of ore and 37,788,263 tons waste and leach material. The concentrator treated an average of 52,135 tons per working day. Copper production in 1956 from the Morenci open-pit mine was 254,312,482 pounds.

The Lavender open-pit mine at Bisbee, Arizona, produced over 15,700 tons of ore per day in 1956, compared with the 12,000 tons originally projected for the mine. At the presently scheduled rate of mining, and on the basis of known minable ore, the corporation estimates the remaining life of the mine at about seven years. Total tonnage removed from the Lavender pit in 1956 was 11,613,546 tons, divided as follows: 5,069,049 tons ore, 3,729,359 tons leach material, and 2,815,138 tons waste. The ratio of waste and leach material to ore was 1.29, compared with 1.81 in 1955. The precipitation plant, built to treat the liquors from the leach dumps, was placed in operation during the early part of the year and 4,810 tons of precipitates were shipped for smelting. Total copper production from the Lavender pit was 80,305,962 pounds of copper, compared to 59,862,955 pounds in 1955.

Material mined by the New Cornelia Branch from the open-pit mine at Ajo totaled 24,616,635 tons, an average per working day of 76,687 tons. Of the tonnage moved, 10,112,434 tons were ore and 14,504,201 tons waste. The ratio of waste to ore was 1.43, the same as in 1955. The concentrator treated 10,092,469 tons of ore during the year, an average of 31,441 tons per working day.

Kermac Nuclear and Holly Bottom Ambrosia Shafts

Two new vertical shafts have been bottomed below the ore horizon in Ambrosia Lake. They are Holly Minerals Corporation's 370-foot deep shaft in Section 14, T. 14 N., R. 10 W., and Kermac Nuclear Fuels Corporation's shaft in Section 10, 14 N., R. 10 W.

Ore will be mined through the Holly shaft in early May to make it the second Ambrosia Lake uranium producer. It is about one mile south of the Dysart No. 1 shaft of Rio de Oro Uranium Mines, Inc. which was the first Ambrosia Lake mine. See August 1952 MINING WORLD. Thin but high grade ore was cut in the shaft at the 350-foot level. Two stations were cut before mining started.

Kermac Nuclear's first shaft is about ⅝ths of a mile west of Rio de Oro. Stations are being cut and development of the ore body will be started immediately. Actual mining is scheduled to start in about 60 days.

Kermac's second shaft, and its first deep shaft, has been collared in Section 22, T. 14 N., R. 10 W. and surface installations are being made. It will take about six months to complete this shaft. The ore horizon is about 875 feet deep.

Duval Reported Ready For Copper Flotation Mill

The Duval Sulphur and Potash Company is reported to have completed design of a 10,000-ton-per-day copper floation mill for its Coronado-Red Mountain-Buena Vista-Bennett claims south of Tucson, Arizona. It is believed that a construction contract has been negotiated and equipment ordered for a crushing plant, a two-stage grinding circuit, cyclonic classification, and flotation machines.

In 1956 Osborne and Thurlow of New York City reported that surface drilling to depths to 250 feet had found and delimited three ore bodies with reserves approaching 80,000,000 tons. These averaged between 0.80 and 1.00 percent copper, with fair molybdenum content and some gold and silver also. Most of this ore can be mined by open pitting following stripping.

Duval has been drilling in the area since November 25, 1953 when it took a lease and option on the claims of Coronado Mines, Inc. Duval is believed to have about 90 claims in the area and is proceeding to patent them. B. G. Messer of Tucson has supervised exploration work. Duval operates a large potash mine near Carlsbad, New Mexico and has headquarters in Houston, Texas.

Inspiration Sinking New Arizona Shaft

Inspiration Consolidated Copper Company reports that excavation at the McDonald shaft site at the Christmas mine, near Winkelman, Arizona, and at the adiacent plant location has begun. Shaft sinking preparations are in progress, and mine development continues as it will throughout the construction period. The company expects to operate the present small concentrator on the property on development ore in 1957. While production will not be significant, the management expects that the metallurgical experience will be invaluable in designing and operating the new mill, tentatively scheduled for a 2,500-ton daily capacity.

In 1956, the company produced a total of 74,166,920 pounds of copper. As in 1955, all ore production came from the Live Oak and Thornton Pits, and underground activity was limited to ore transportation and collection and pumping of leaching-in-place solutions. The ore carried 0.976 percent total copper, of which 0.496 percent was oxide copper and 0.480 percent sulphide copper.

In January 1957, Inspiration placed in operation its rehabilitated and re-equipped concentrator for treatment of ore by the dual metallurgical process. This process involves the extraction by sulphuric acid leaching of copper from the oxide fraction of the ore. The washed and drained tailing from this operation is then treated by fine grinding and flotation concentration for recovery of values occurring in sulphide form. The change in metallurgy will release a large portion of the capacity of the electrolytic tank house and which will be used for the electrolytic refining of anode copper produced by the smelting, on a toll basis, of concentrates from the rehabilitated mill. By mid-1957, the company expects its total output will be in the form of cathode copper.

The *Wah Chang Mining Corporation* of Bishop, California, is actively prospecting the *Copper King* mine near Bagdad, Arizona. The shaft has been rehabilitated to the 600-foot level and some crosscutting and drifting undertaken. *McClintock Drilling Company* of Spokane, Washington, has the contract for diamond drilling. The Copper King mine is located approximately 1.5 miles southwest of Bagdad and has a production record well in excess of a million dollars. Mike Price of Bishop, California, is general superintendent directing the current exploration.

Miami Copper Company, Miami, Arizona, has announced that production at its *Copper Cities* open-pit mine went on a six-day work week effective April 8. Copper Cities had been on a seven-day schedule since the start of production in the summer of 1954. As a result, about 30 employees will be dropped from the working force. No change is planned at the Miami mine where a six-day production week has been effective for several years, stated General Manager Ben Coil.

Shattuck Denn Mining Corporation reports that the 1956 mill production at its *Iron King Branch,* Humboldt, Arizona, totaled 48,865 tons of concentrates with a content of 32,112,288 pounds of zinc, 12,260,312 pounds of lead, 609,927 pounds of copper, 25,509 ounces of gold, and 836,246 ounces of silver. According to Thomas Bardon, president, a continuing high level of production is expected in 1957 at the Iron King, provided the price of zinc, the company's major product, is maintained at its present level.

A $2,500 fellowship for research in the *University of Arizona College of Mines* and the *Arizona Bureau of Mines,* Tucson, Arizona, has been established by the *Shell Chemical Corporation* of New York. Research under the fellowship will be directed toward an evaluation of various chemical compounds that are used as flotation reagents in the minerals industry. Work under the fellowship will begin next June and will lead to the degree of master of science in metallurgical engineering.

Rare Metals Corporation of America's new uranium mill is operating at capacity at Tuba City, Arizona. The 250-ton per-

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day resin-in-pulp mill is serving the Monument Valley mining area treating ore from its own properties and from other producers in the district.

The *Golden Crown Mining Company* has purchased the Grand Canyon Inn, on the south rim of the Grand Canyon, about a mile west of the village of Grand Canyon, Arizona. The purchase reportedly was made to increase the mining company's surface rights around its *Orphan* mine which lies 1,300 feet below the rim and slightly to the east of the Inn. The 20 acres involved are the only privately owned land within the Grand Canyon National Park. Golden Crown began regular shipments of uranium ore from the Orphan mine last August. Ore is brought to the rim by means of an aerial tramway, then trucked 92 miles to *Rare Metals Corporation's* mill at Tuba City, Arizona.

Continental Uranium, Inc. of Grand Junction, Colorado has dropped the option on the Monument Valley properties it had obtained from *Spencer Uranium Company* in northern Arizona. Continental completed a drilling program on the properties but plans no additional development or mining.

CALIFORNIA

Kern Uranium Company, which reported a uranium strike on its property in Kern River Canyon, California, a few months ago, has started shaft sinking operations. Some drilling and extensive surface work indicated that the ore body dips about 80°. The first level of the vertical shaft will be at 50 feet. The firm's property is on the bank of the river between the *Miracle* and *Kergon* mines.

The *United States Geological Survey* is drilling a number of test holes in the region near Boron, California as part of a survey of the Mojave Desert's mineral resources. The first test hole sunk in the Boron area was 2,350 feet deep. A laboratory study of the core is being made.

Natomas Company confined its operations last year to the Folsom district, California where it had four dredges in continuous operation. A fifth dredge closed down in March 1956. Average monthly gold production in the district was 13 percent less than during the previous year. This was due essentially to a 11.5 percent reduction in total yardage dredged and also in part to a 1.5 percent decrease in the gold content of the gravels.

Fairview Placers, a joint operation of *Sunshine Mining Company* and *Canadian Dredging Company*, is preparing to negotiate with the *U.S. Bureau of Reclamation* concerning its properties which are in the reservoir area behind the proposed Trinity River Dam, which should be under construction soon.

A. F. Oddstadt, Jr., who has been mining mercury ore in Stulsaft Park, Redwood City, California, is reported to have opened a second open pit about a half mile from the first. A 50-ton-per-day processing plant has been erected about four miles away. Meanwhile, the Redwood City Council still has not approved the one-year lease which started July 1, 1956. It was suddenly discovered last

year that although the city council and Mr. Oddstadt had agreed on terms of the lease, no written document had been executed.

NEVADA

A lower tunnel at the *Tungsten Mountain Mining Company* property near Fallon, Nevada, has located the downward extension of a high-grade scheelite vein cut off by a horizontal fault after yielding $100,000 worth of ore in near-surface workings. At last report the shoot had been opened for 40 feet and averaged 6 feet wide and 3 percent tungsten trioxide. Arthur Lakes, geologist and mining engineer formerly of Spokane, Washington, and Nelson, British Columbia, directed the work. B. W. Porter, Seattle, is company president.

Consolidated Coppermines Corporation shipped 3,180,713 tons of copper ore in 1956, with 83.7 percent of this coming from the Tripp Pit; the remainder had been mined in joint operations. This was the first full production year from the Tripp which had produced only 220,026 tons in 1955, compared with 2,881,000 tons in 1956. As of December 31, 1956, 15,044,000 tons of overburden had been removed since start of operations. The company purchased $750,000 worth of additional mining equipment during the year.

A fire of undetermined origin broke out on the 1,800-foot level of the Humboldt shaft of *Nevada-Massachusetts Company* recently, the first mine fire in Nevada since 1949. The shaft was sealed off below the 1700 level and remained sealed until it smothered itself. The property is located at Tungsten, Nevada, in Pershing County. It is one of the largest tungsten producers in the state.

The three-compartment winze from the 600-foot tunnel level has been completed in the *Lincoln* mine of *Wah Chang Mining Corporation* at Tempiute, Lincoln County, Nevada. Stations have been cut and development work is progressing on the 760 and 900 levels. Power is now available from the Hoover Dam with the erection of a 63-mile, high tension, power transmission line.

Law Exploration and Development Corporation has been organized in Reno, Nevada by Marx Law to manufacture and put into operation special pieces of mining equipment developed by Mr. Law over the past 14 years. The equipment will be used to develop mining properties on a lease basis, as well as to improve properties Mr. Law has turned over to the corporation.

Alpine Eureka Mining Corporation of Nevada has been organized to acquire and operate the old *Mogul* mines in the Mogul mining district 7½ miles south and east of Markleeville, Alpine County, California. Alpine purchased the mines for $300,000. During the spring and summer of this year, an initial program of field work, including geophysical surveys, and then drilling to a depth of about 1,000 feet for core studies, will be started. If drilling confirms surface sampling, open-pit operations should start late in 1957 or early in 1958.

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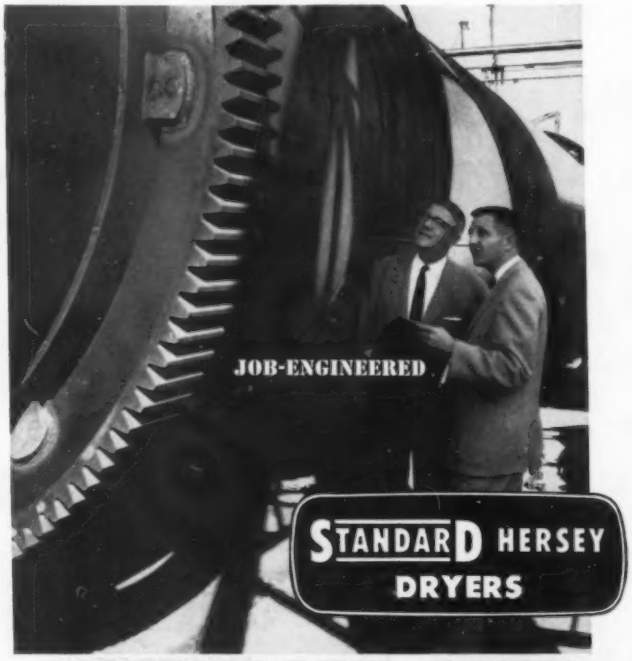
Four Corners Exploration Company of Grants, New Mexico, working under a farmout agreement with *United Western Minerals Company* (see MINING WORLD, February 1957, page 84), has discovered a uranium ore body in the Ambrosia Lake area of McKinley County, New Mexico. Specifically, the strike was made on the southern half of Sec. 14, T. 13 N. R. 9 W., nine miles southeast of Ambrosia Lake, and 15 miles north and east of Grants. Averaging 10 feet in thickness, the ore body was found at a depth of 280 feet. United Western has exercised its option to take 50 percent working interest in the property, with half of this passed to its farmout partners; Four Corners gets 30 percent, and the remaining 20 percent goes to the estate of S. Paul Dooley of Grants, who contributed some of the mining claims.

The new shaft being sunk by *Homestake-New Mexico Partners* in the Ambrosia Lake district of New Mexico has been collared, timbered, and a permanent headframe erected. The six-foot by 14-foot shaft will accommodate two hoist compartments and a small manway compartment.

Anderson Brothers Corporation expects its new $150,000 manganese concentrating mill 25 miles southwest of Socorro, New Mexico to be in operation by the end of this month. The mill's capacity ranges from 720 to 1,440 tons per day. Ore will come from the company's open-pit mine on the *Tom E. Kelly* lease in the Silver Mountain mining district of Socorro County.

Rare Metals Corporation of America has moved into the Ambrosia Lake area of New Mexico with an exploratory drilling program. A total of 50,000 feet of drilling is planned on two separate projects. Two rigs are operating on a 24-hour basis in Sec. 16, T. 14 N., R 9 W., McKinley County, while seven miles to the



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southeast, a single rig is at work in Sec. 30, T. 13 N., R. 8 W., Valencia County. Some drilling will also be done in Sec. 29, T. 13 N., R 8 W., and two additional rigs will complete the program in sections 29 and 30.

Kennecott Copper Corporation plans to spend more than $6,000,000 on major equipment items at its New Mexico operations during 1957. Nearly $3,000,000 will be spent to enlarge the company's power generating capacity at its Hurley power plant. More than $500,000 will be spent on additional rail equipment in the open-pit copper mine at Santa Rita. Other expenditures will provide equipment needed to open a new mining area in the pit, add new equipment at the Hurley concentrator, and additional shop space at Santa Rita.

The Electro-Winning Corporation, with headquarters in Albuquerque, New Mexico, has been formed to develop a new process of milling uranium ore. Incorporators are: Edward G. Parham and Jack Morris, of Albuquerque, and Theodore Crawford and Archie Peeler of Los Alamos. The product is a portable type of mill.

International Minerals & Chemical Corporation has introduced a cable-supported conveyor in its potash mines at Carlsbad, New Mexico. By reducing the length of hauls, the 42-inch-wide conveyor belt releases two shuttle cars per shift for use in other parts of the mine, and still permits langbeinite tonnage to be maintained. This is possible because it reduces by 500 feet the distance shuttle cars must haul ore from the face. Dumping into the upper end of the conveyor, two shuttle cars are able to handle the production from a loading machine more efficiently than four cars could with the longer haul. As mining progresses in the area, the conveyor will be extended in 150-foot units, keeping up with the dumping hopper as close as possible to the face.

Consolidated Metals Exploration Company of Roswell, New Mexico has opened the *La Majada* uranium and copper mine in Santa Fe County. An exploration shaft is being sunk, with operations under the direction of Carlton H. Rhembrandt of Albuquerque.

Kermac Nuclear Fuels Company has awarded a shaft sinking contract to *Patten & Galassini* of Silver City. The firm will sink a 550-foot, three-compartment shaft in the Ambrosia Lake district. In the same area, *Boyles Brothers Drilling Company* of Salt Lake City, Utah will sink a five-compartment for *Phillips Petroleum Company*. The ore zone is reported to be at about 750 feet.

Lone Star Mining & Development Company is reactivating an old copper property south of Santa Fe, New Mexico. A recent sample assay is said to have shown 1.0 percent germanium and 3.0 percent copper.

A bill has been introduced in the New Mexico state legislature that would particularly affect uranium mining. The bill would amend the present law requiring the digging of a 10-foot-deep pit to prove the existence of workable minerals. It would sanction, instead, the findings of core drilling. Many operators are currently core drilling, and then digging pits to comply with the law. Ranchers do not like the land cut up that way and point out that it is a hazard to man and beast.

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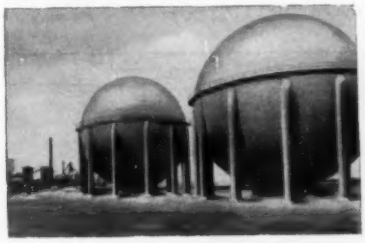

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St. Joseph Lead Company will undertake extensive drilling this spring on a lead prospect in Washington County, Missouri. The company's *Indian Creek* property in that county is now in its third year of operation. It reached full capacity in 1956 with a rate of 2,000 tons of ore per day. Ore and chat milled from the Lead Belt last year by St. Joe totaled 7,195,413 tons, as compared with 1955 when 7,398,730 tons were milled. Because of the lower grade of ore being mined, lead content of concentrate, on a 90 percent basis, also showed a slight decrease from 101,932 tons to 100,707 tons. Zinc recovered in 1956 was 3,152 tons as compared with 3,746 tons in 1955.

American Zinc, Lead and Smelting Company expects to bring its Piquette No. 2 ore body in southwestern Wisconsin into production during this year. The *Piquette* mine operated at capacity all of last year producing 8,367 tons of zinc-lead concentrates. Operations at *Vinegar Hill* were conducted on an intermittent basis last year resulting in an output of 9,675 tons of zinc-lead concentrate. Development of the *Temperly* and *Thompson* properties acquired from *Cuba City Mining Company* has been good and both properties should be in production by the end of the second quarter in 1957.

The *Calumet Division* of *Calumet & Hecla Inc.* at Calumet, Michigan produced 37,813,735 pounds of primary copper in 1957, compared with 27,376,095 pounds in the previous year; however, a severe strike in 1955 had caused much of that decrease in output. The work of rehabilitating the *Osceola No. 6* shaft reached a point below the 43rd level. Permanent pumps have been installed on four levels in the mine and the bottom submersible pump in No. 6 shaft used in unwatering has been returned to the surface. The 500-horsepower station pumps have also been removed and the 12-inch pump column has been converted to an air column.

White Pine Copper Company, a subsidiary of the *Copper Range Company*, will make capital expenditures this year running between $3,000,000 and $3,500,000 to build up the annual production rate to between 90,000,000 and 100,000,000 pounds by the end of the year. Production in 1956 total 75,516,312 pounds of copper compared with 63,931,246 pounds in 1955. The company expects that its ore reserves will support this further substantial increase in production.

The *Lead Industries Association* will sponsor a fellowship in the Department of Ceramic Engineering, University of Illinois, for the academic year 1957-1958 for research on lead in ceramics. A similar grant has also been made to Rutgers University.

The J. B. Arthur and Family Scholarship-Loan Fund has been established at the *University of Missouri School of mines and Metallurgy* at Rolla, Missouri. This $28,000 fund with a novel cost-of-living increase clause is the first of its kind in the history of the school to be specifically assigned to students in the Department of Ceramic Engineering. The gift is from the president of *Mexico Refractories Company* at Mexico, Missouri, as a personal response to the refractories industry's long-term program for encouraging high school students to enter this profession.

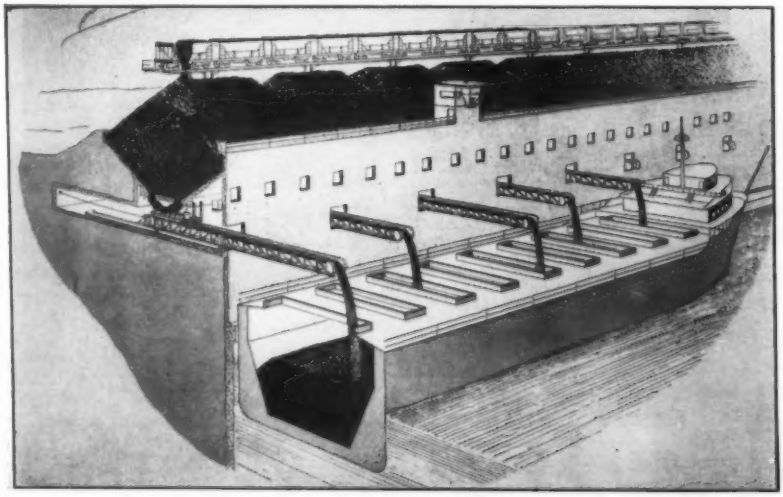
The *United States Geological Survey* has released a report describing the occurrences of uranium in northern Michigan. Uranium deposits in this area include occurrences of pitchblende, associated with sulphides, and occurrences of secondary uranium minerals. The author, R. C. Vickers, believes that uranium and associated metals have been deposited by downward-moving ground waters which leached the elements from the Michigamme slate of upper Huronian age. The report has been placed in open file in the libraries of the Geological Survey in Washington, D. C., Denver, Colorado, and Menlo Park, California; in the office of the Geological Survey, Iron River, Michigan, and Madison, Wisconsin; and in the office of the Geological Survey Division, Department of Conservation, Lansing, Michigan.

The new 750-ton mill in operation at the *Ore Knob* copper mine of *Appalachian Sulphides, Inc.* is expected to reach full capacity in August. The addition of a ball mill and flotation cells is needed to attain this. The mill which went into operation in March is currently producing copper concentrates only, although it is possible that a pyrrhotite concentrate may be produced later. Ore reserves in the mine are currently estimated at about 1,300,000 tons, averaging about 3.0 percent copper. Appalachian is a subsidiary of *Nipissing Mines Company Ltd.*

The mercury purchase guarantee program has been extended through 1958. It had been scheduled to end on December 31, 1957. The extension will permit purchase of up to 50,000 flasks at a guaranteed price of $225 per flask during that period. A total of 30,000 flasks may be acquired from domestic sources, including Alaska, and 20,000 from Mexico.

At the *Sterling* mine of *New Jersey Zinc Company* in Ogdensburg, New Jersey, crushing and grinding equipment is being installed in the mill pending start of operations in the fall. The 2½-mile tunnel being driven between the *Austinville* and *Ivanhoe* mines at Austinville, Virginia was completed on February 19th. The tunnel will provide a haulageway for lead and zinc ores from the Ivanhoe to the Austinville, and a means for quick transportation of material and supplies between the two mines. In Tennessee, the firm recently purchased more land. Sixteen acres in the *Goin* section of Claiborne County were bought from Fred Killion, and the firm also exercised its three-year option by buying the mineral rights on 150 other acres. Mineral rights were purchased from J. C. Killian, Elmer Carmon, G. G. Lynch, and William H. Lynch.

Heavy Minerals Company, owned by *Crane Company* and *Vitro Corporation of America*, has started partial production at its Chattanooga, Tennesee plant. The



New Belt Conveyor To Load Taconite Pellets

A new system of 25 shuttle belt conveyors, the first of its kind ever used to load Great Lakes ore vessels, will load taconite pellets at Erie Mining Company's Taconite Harbor, Minnesota port facility on Lake Superior when it goes into operation sometime in 1958. The belt conveyor system permits the loading of as many as 10 alternate hatches simultaneously, a departure from the conventional method of loading ore vessels by chutes. Two vessels can be loaded at the same time, and the complete system of shuttle belts for each vessel is operated from a central control tower. As shown in the cutaway drawing, the pellets arrive at the deck in rail cars, are emptied into a storage bin and weighed as they are loaded into hatches. Each of the 25 shuttle belt conveyors on the 1,200-foot-long dock is capable of loading taconite pellets at the rate of 750 or 1,500 long tons per hour at belt speeds of 250 or 500 feet per minute. The system was designed and built by Link-Belt Company.

plant is producing a thorium compound and rare earths products. It is designed for separation and purification of rare earths and rare earths compounds, and is the first to reduce monazite by the caustic soda process.

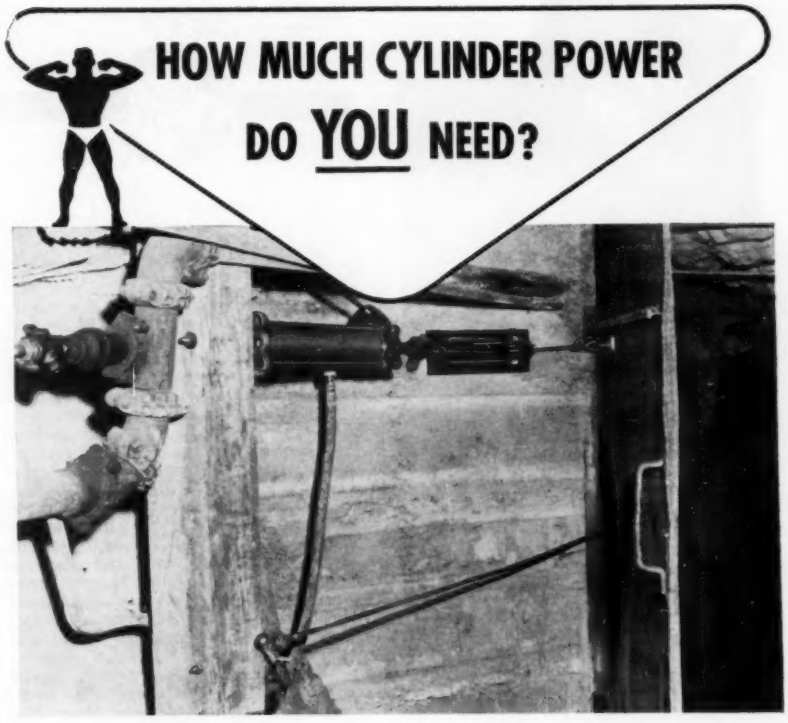
Kaiser Aluminum & Chemical Corporation has opened a half million dollar plant near Nichols, Florida to recover fluorine from phosphate wastes for use in aluminum manufacture. The plant is located on the phosphate property of *Virginia & Carolina Chemical Company*. If the method of extraction is successful, other plants will undoubtedly be built in other phosphate fields. It is estimated that there is one three-hundredth of a ton of fluorine in every ton of phosphate rock. The Florida and South Carolina phosphate mines produce about 10,000,000 tons annually.

American Zinc Company of Tennessee expects to begin production from its *Coy* mine at approximately 25 percent of capacity by the end of June and to be producing 500 tons a day by the end of 1957. Installation of surface equipment had been retarded by work stoppages in the electrical and steel industries. The company's *Mascot No. 2, Grasselli,* and *North Friends Station* mines operated at capacity during all of last year. Total production from Tennessee operations was 46,237 tons of concentrate, an increase of 21 percent over 1955. The *Athletic* mine was closed in October and will be operated as a part of the Coy at a later date. The company completed 450,000 feet of diamond drilling in the Southwest New Market Area which resulted in six ore discoveries containing an estimated 35,000,000 tons of ore or about 2,000,000 tons of 60 percent zinc concentrates. Mineral rights are being purchased in this area as options expire, but no further development will be done here until 1958.

Kennecott Copper Corporation reports that in the first two months of 1957 sales were in excess of production. Charles R. Cox, president, believes the need is for additional copper deposits, and their exploration program is mainly directed toward this end. In 1956, the company produced 582,205 tons, while sales amounted to 495,219 tons. Other production last year included: 16,269 tons of molybdenite, 403,381 ounces of gold, 3,213,559 ounces silver, and 148,455 pounds of selenium.

A research partnership has been formed by *Ionics, Incorporated* of Cambridge, Massachusetts, and *Diamond Alkali Company* of Cleveland, Ohio. Under the sponsorship of Diamond Alkali, Ionics will pursue varied chemical research programs, including applications of ion exchange membranes developed by Ionics. This research will be done in Ionics' Cambridge facilities, but company personnel will work closely with Diamond's Research and Development staff at Painesville, Ohio.

Stockholders of *National Distillers Products Corporation* have been asked to approve a change in name to *National Distillers & Chemical Corporation*. If approved, the beverage division would be operated as the *National Distillers Products Company,* and the chemical division would continue as *U.S. Industrial Chemicals Company*. The latter is currently building a 2,000,000-pound-per-year, reactor-grade, zirconium sponge plant near Ashtabula, Ohio.



Ledeen Heavy Duty Cylinder Operates Air Doors in Western Mine

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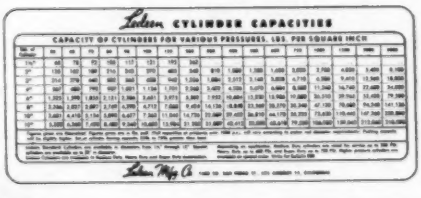
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IRON RANGES

The 1957 iron ore shipping season on the Great Lakes opened on April 1 when *Inland Steel Company's* freighter, the *L. E. Block*, arrived at the *Chicago & North Western Railway's* iron ore loading dock at Escanaba, Michigan.

Oliver Iron Mining Division of the *U.S. Steel Corporation* will operate at a new property this season—the *Delaware No. 1* which will be worked in connection with the adjoining *Arcturus* mine near Marble on the western Mesabi. In the same area, the company will also mine from its *King* and *Plummer* mines. On the eastern Mesabi, the newly opened *Stephens* mine near Aurora, the *Gilbert* and *Canton* open-pit mines, the *Spruce* mine at Eveleth, and the *Rouchleau* group in the Virginia area will all be in operation. Ore will also come from the *Sherman* group near Chisholm, the *Monroe* open-pit mine, and the *Hull-Rust* and *Morris* mines at Hibbing. Underground mines Oliver will operate during the 1957 season are the *Pioneer* and *Soudan* mines on the Vermilion range. The company is also constructing large ore sizing units at its Rouchleau crushing and screening plant at Virginia and its Sherman crushing and screening plant at Chisholm.

After 70 years of production, the *Anvil-Palms* mine operated by *Picklands Mather & Co.* at Ramsay, Michigan has closed. The mine included four leases, the *Anvil, Palms, Keweenaw,* and *Massie*, with shipments starting from the Anvil and Palms in 1887. Ore was mined and shipped from the Massie only during 1926 to 1929. Pickands Mather operated the mine for *Youngstown Mines Corporation.* Shipments since 1887 totaled more than 21,000,000 tons.

Hanna Ore Mining Company, The M. A. Hanna Company, agents, has started preliminary work on the development of the *Norpac* mine. Plans for the stripping operation are nearing completion and some preparatory work will get underway in 1957. The 30-cubic-yard capacity dragline and conveyor system which was used to strip the *Morton* mine has been moved to the Norpac area. Present plans also call for erection of a beneficiation plant.

Pacific Isle Mining Company of Hibbing, Minnesota hopes to have the *Iroquois* iron mine at Mountain Iron in production for the 1957 shipping season. The company is removing overburden and will operate the mine when ready for ore production. The Iroquois is the property of the *Inland Steel Company,* located adjacent to the *Wacootah* open pit mine of Pacific Isle. Originally operated as an underground mine in 1903, last shipments were made from the property in 1914.

Cleveland-Cliffs Iron Company reports record earnings for 1956 despite the five-week steel strike. Although Lake Superior District iron ore shipments dropped approximately 11 percent, the company's total shipments dropped only 1.9 percent. Sales and operating revenue amounted to $119,769,000 in 1956 as compared with $114,457,000 in 1955. The firm's research department is continuing to investigate different concentrating and agglomerating processes, and of particular interest, they report, is a pilot plant operation started late in 1956 in which non-magnetic low-grade ore is converted to artificial magnetite. By using a reducing gas and relatively high temperatures the non-magnetics material is converted to magnetite which can then be concentrated by magnetic separation rather than oil flotation. Extremely high grade concentrates can be obtained from jasper by this "magnetic oxide conversion" method.

Three stockholders of *Mesabi Iron Company* has asked that a lease of the company's taconite properties to *Reserve Mining Company* be cancelled, and that Reserve give an accounting on the proper amount of Mesabi's share of Reserve's profits. The stockholders are objecting to a report from Reserve which showed a net loss of $4,380,854 in 1956 despite sales totalling 3,500,000 tons of iron pellets. Reserve leases the taconite property from Mesabi under an agreement which gives Mesabi 33 1/3 percent of the net profits. Reserve is owned jointly by *Republic Steel Corporation* and *Armco Steel Corporation.* Mesabi itself has been protesting the accounting methods for a number of years.

Pickands, Mather & Co. has been given management responsibility for the *Cornell* iron ore mine near Iron Mountain, Michigan, recently acquired by *Interlake Iron Corporation* through a merger with *Globe Iron Company.* The Cornell began shipping iron ore in 1880, closed in 1887, was reopened by Globe by 1935, and has oftened been referred to since as the Globe-Cornell.

The *Chicago & North Western Railway* has closed its ore dock at Ashland, Wisconsin. Shipments of iron ore from the Gogebic iron range out of Ashland will now be handled by the *Soo Line Railway* dock at the port which is more modern. A joint traffic agreement has been negotiated between the two lines for ore shipments over a single dock. A similar agreement exists between Soo and the Northern Pacific Railway on joint use of a single ore dock at Superior.

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Canada Will Be Host to Commonwealth Mining And Metallurgical Congress in September

Canada will be the mining center of the world in September and October during the Sixth Commonwealth Mining and Metallurgical Congress. More than 500 delegates from all parts of the world will attend. The Congress will convene at Vancouver, British Columbia on September 8 for a three-day session. Following this initial meeting, delegates will leave by airplane and train on a series of tours extending to all of Canada's important mining and metallurgical districts. The final session will start at Halifax, Nova Scotia on October 9. Evidence of the success of the Congress is that registration in March totaled 225 from abroad, including 60 from South Africa, 40 from Australia, and 45 from the United Kingdom.

Participating in the Sixth Congress will be the constituent institutions numbering 28,000 members and comprising the Commonwealth Council of Mining and Metallurgical Institutions. These are: The Australasian Institute of Mining and Metallurgy, The Canadian Institute of Mining and Metallurgy, The Institute of Metals (London), The Institution of Mining Engineers (London), The Institution of Mining and Metallurgy (London), The Institute of Petroleum (London), The Iron and Steel Institute (London), The Mining, Geological and Metallurgical Institute of India, The South African Institute of Mining and Metallurgy, and The South Wales Institute of Engineers.

The decision to extend the invitation to hold the Sixth Congress in Canada was reached after careful consideration of several pertinent factors, including:

(1) Canada's present position of world leadership and world-wide importance in metal mining, and metallurgical processing.

(2) Expectation of a full measure of support from the Government of Canada and the Governments of the respective provinces.

(3) The impressive measure of success that attended the Second Congress, held in Canada in 1927.

Included in the main features of the program for the Sixth Commonwealth Mining and Metallurgical Congress are the following: A cross-Canada tour from Vancouver to Halifax by chartered trains. An aerial tour of Northern British Columbia, Yukon, Northwest Territories, Northern Saskatchewan, and Northern Manitoba.

Inspection visits to more than 50 major centers of mining and metallurgical operation.

A most important undertaking of the Sixth Congress will be publication of five technical volumes on various aspects of the mineral and metal industries in Canada. The General Committee for the Congress has undertaken to sponsor publication of these technical volumes in the belief that they will be a most desirable and important feature of the Congress. In addition to serving as a comprehensive report to delegates on the mining industry in Canada, it is expected that these volumes will quickly achieve widespread use as textbooks and technical references, and will prove to be most valuable additions to the mining literature of Canada.

Specially prepared brochures and other literature in standardized format to provide descriptive details of the Canadian mineral industries, the installations visited on the tours, and the main cultural points of interest in Canada will also be made available to delegates.

Before extending invitations to people in other countries the Congress wanted to make sure that the member organizations within the British Commonwealth had ample opportunity to make reservations, but now applications for registration will be entertained from the United States and other countries. Official invitations are now being extended to the top officials of various United States mining and metallurgical associations. All reservations, including hotels, are made by the Congress once the application has been processed.

Inquiries and requests for information should be directed to: C. C. Huston, chairman, Publicity and Information Committee, Sixth Commonwealth Mining and Metallurgical Congress, 2001-80 Richmond St., West, Toronto, Ontario, or to The executive secretary, Sixth Commonwealth Mining and Metallurgical Congress, 507-837 W. Hastings St., Vancouver 1, British Columbia.

U.S. To Buy Nickel From Freeport Project

The United States Government has agreed to buy nickel and cobalt metal produced from new facilities to be built by Cuban American Nickel Company, a subsidiary of Freeport Sulphur Company, at Moa Bay, Cuba and in the United States. The government will buy, at today's market prices during a period ending June 30, 1965, up to 271,000,000 pounds of nickel metal and 23,835,000 pounds of cobalt metal, and has the right to require the delivery of up to 30 percent of the annual output, presumably for the stockpile.

Freeport plans to spend $100,000,000 on the project which also includes a refinery near Braithwaite, Louisiana which will utilize a new process for the recovery of nickel and cobalt metals. An output of 50,000,000 pounds of metallic nickel and 4,400,000 pounds of metallic cobalt per annum is planned. Last fall the company completed the successful operation of a pilot plant which was built and operated in cooperation with the government and which was designed to test the new process.

The ore will first be concentrated in the new plant at Moa Bay, and then shipped to Louisiana for refining. Vessels on the return trip will carry Freeport's liquid sulphur for use in the Cuban operation. Production is expected to begin in the middle of 1959.

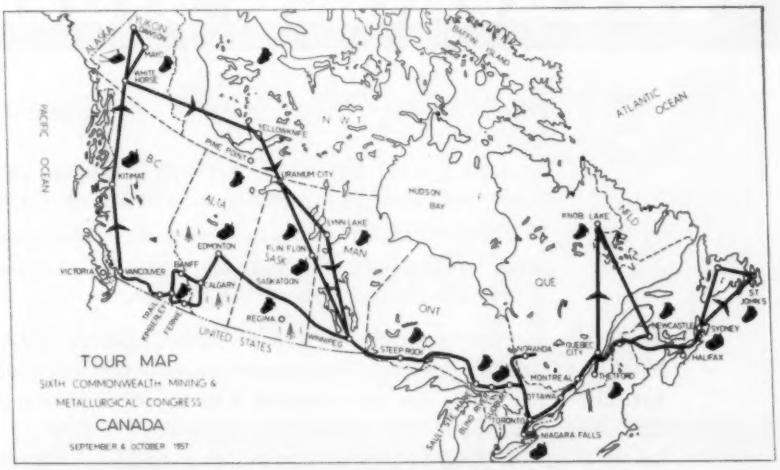
Rio Tinto Purchases Rhodesian Nickel Mines

An option to purchase the mineral rights of the Empress nickel mines near Gatooma, Southern Rhodesia for a total of £250,000 has been exercised by the Rio Tinto Mining Company of Central Africa Limited, under the terms of an agreement with Mrs. M. M. J. Leslie, former owner. The Rio Tinto Mining Company of Canada Limited holds a 35 percent interest in these Empress nickel claims. It is expected that a program of drilling will be completed within the next few months.

National Lead To Explore On Barvallee Property

Barvallee Mines Ltd. has granted a six-month option to National Lead Company, New York, to explore its property in Fiedmont Township, west of Barraute, in northwest Quebec, Canada. In recent months Barvallee has undertaken extensive drilling operations and found encouraging evidence of worthwhile deposits of zinc, copper, and silver.

National Lead will furnish all necessary funds for a six-month exploration and development program, with an option to continue for a further six months. If National Lead decides to exercise the option, a new company will be formed in which National Lead will have a 60 percent interest and Barvallee, 40 percent. National Lead would be responsible for providing all necessary capital up to and including production, but Barvallee would have the right to participate up to 40 percent in such financing.



Route of planned tours. Symbols indicate plants to be visited.

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ITALY—*Società Ferromin*, a subsidiary of the government-controlled steel producer *Finsider*, discovered a large deposit of pyrite-magnetite ore, associated with lead-zinc sulfides, several years ago while drilling near the Mt. Argentario iron-manganese mine (Italian west coast, 100 miles north of Rome). A new drilling program is underway to define the extent of the ore which is contained in brecciated limestone several hundred feet below the level of the adjoining Tyrrhenian Sea. Underground water will be the chief problem in developing the deposit.

U.S.S.R.—Large iron ore deposits, estimated at over 300,000,000 tons, have been discovered in eastern Siberia near the town of Chita. Other deposits have been reported at Kursk, south of Moscow, with an iron content of 60 percent and reserves estimated at 250,000,000 tons.

NORWAY—Prospecting for ore by airplane will begin in earnest within the next few months when a Lockheed 12, owned by the Norwegian Department of Commerce, has been mounted with the necessary equipment.

GREECE—*Kennecott Copper Corporation* of the United States is undertaking a program of geological testing and diamond drilling to determine the extent and quality of an asbestos deposit in Greece. Preliminary investigation was sufficiently encouraging to warrant drilling and testing during 1957.

AUSTRIA—Iron ore production in Austria set a new record during 1956 with 3,257,887 tons, compared to 2,838,450 tons produced in 1955.

ITALY—Final official statistics on exports of quicksilver from Italy show a total of 74,994 flasks, compared with 27,927 flasks exported in 1955.

GREECE—In 1955 a contract was signed by *Parnassus Bauxite Company* to supply 25,000 tons of bauxite for Russia. Further reports are that *Delphi Bauxites* is also making shipments of bauxite to the U.S.S.R.

NORWAY—During 1956 *Kautokeino Kobberfelter* undertook extensive diamond drilling of the copper deposits at Bidjovagge near Kautokeino in the northernmost part of Norway. The results have been encouraging and investigations will be continued this summer.

EIRE—Perlite has been found in the Ballyclare district of County Antrim. A prospecting license has been granted to *Gotham Ltd.*, a subsidiary of *British Plaster Boards Holdings Ltd.*

FINLAND—After extensive prospecting, the *Finnish Geological Research Institute* has now started test drilling at Haapavesi and Nivala in western Finland. The ore field has been mapped by use of magnetic equipment.

SCOTLAND—*Lowland Lead Mines*, a subsidiary of *Siamese Tin Syndicate Ltd.*, estimates that ore reserves are over 96,000 tons at its property at Lead Hills, Lanarkshire. An exploratory crosscut has

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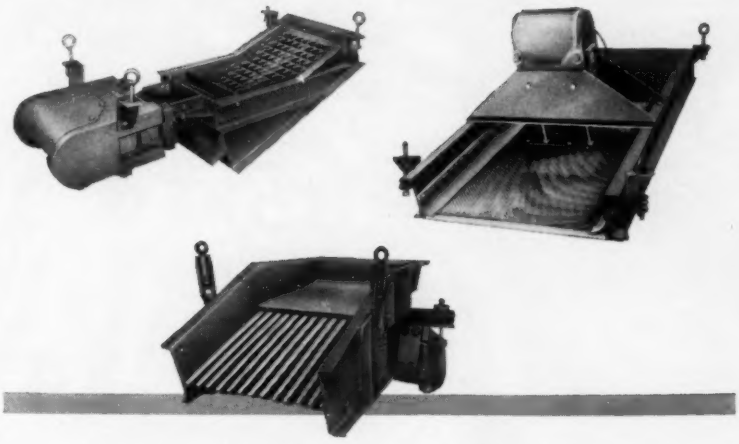

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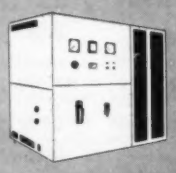

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intersected a number of promising veins. Construction of the treatment plant to handle old dumps and current mine ore is nearing completion.

NORWAY—A sulphuric acid producer, *Lysaker Kjemiske Fabril A/S*, is investigating the possibility of pyrite production from some parts of the silver mines at Kongsberg in southern Norway which were closed last fall after 300 years of operation.

WEST GERMANY—*August Thyssen-Huette* A.G. of Duisburg-Hamborn has consolidated with *Niederrheinische Huette A.G.* through an exchange of stock. This brings together Germany's foremost steel producer and largest steel wire manufacturer. The action was given full approval by the six-nation High Authority of the European Coal and Steel Community.

SWEDEN—The International Mineral Dressing Congress will be held in Stockholm from September 18 to 21, 1957. Technical sessions will meet at the Royal Institute of Technology. About 25 papers will be presented and discussed within the following groups of subjects: mineral structure and comminution, classification and gravity separation, magnetic concentration, roasting and sintering of iron ores, flotation, mineral processing by chemical methods, treatment of uranium ores. Contact the General Secretary of the Congress at Nackstromsgatan 1, Stockholm for further information.

NORTH AMERICA

NEW BRUNSWICK—*Heath Steele Mines Ltd.'s* new mill is in the tune-up stage at present and full production is expected by the middle of this year. A subsidiary of *American Metals Company* which owns 75 percent and *International Nickel Company of Canada* which owns 25 percent, the firm is developing ore bodies near Newcastle. American Metals had spent nearly $11,000,000 on construction of the mill and related facilities by the end of 1956. These facilities will permit an operation at a rate of 1,500 tons per day. During the initial stages of production, ore will be mined from small open pits and underground. The ore produced will be of two types, copper ore and lead-zinc-copper ore, which will be treated in separate sections of the mills. A 22-mile spur line to the property is expected to be completed by *Canadian National Railways* by the end of this year.

QUEBEC—*American Smelting and Refining Company* has formed a Canadian subsidiary, *Asarco Nickel Company*, to take over the two concessions of *LeMoyne Ungava Mines* where nickel-copper has been discovered. ASARCO is prepared to advance the money necessary to carry the project through to production if it is warranted. The immediate program calls for a joint aerial electromagnetic survey. This will be followed by geophysical surveys, detailed mapping, and about 20,000 feet of diamond drilling. ASARCO will receive 63 percent of the profits after all advances are returned, if the property is brought into development.

ALASKA—*The U.S. Smelting Refining and Mining Company* plans to operate three dredges at Nome, one at Bear Creek, and seven at Fairbanks this coming season. Of the seven at Fairbanks, one will complete dredging in its present area about the middle of the season and will be made ready for a winter move to a new area some five miles distant. It is also expected that two others will have shorter than normal operating seasons this year. Dredges Nos. 6 and 10 were the first to open the season with snow removal and ice cutting operations.

ONTARIO—*Cobalt Consolidated Mining Corporation Ltd.* hopes to have its 400-ton Penn-Cobalt mill in operation by late spring. Underground work is being concentrated on development and preparation for mining of silver ore zones in the company's *Christopher, Cobalt Lode*, and newly opened *Temiskaming* mines. Development work is also being done on a wide silver zone with considerable leaf silver in evidence from a winze that has been sunk in the *Agaunico* mine. Mill grade silver ore is being stockpiled and high-grade silver cobbed and prepared for shipment, until completion of the mill. Cobalt ores are being treated exclusively at the La Rose mill and a local 110-ton mill which the company has leased.

NEW BRUNSWICK—*Anaconda Company (Canada) Ltd.* continues its investigation of the Bathurst District where the company has obtained, by option and purchase, a substantial acreage containing zinc, lead, and silver mineralization with subordinate copper. Approximately 35,000 feet of diamond drilling was completed in 1956 and confirmed the presence of a large tonnage of sulphide material. In northwestern Ontario near Nakina, the company also has a large acreage of ground under option. This is said to contain substantial tonnages of low-grade iron mineralization. Investigation is continuing here, also.

ALASKA—*Kendrick Bay Mining Company*, owned by *Climax Molybdenum Company*, Don Ross, Kelly Adams, et al, will sell its uranium ore to the *Dawn Mining Company* at Ford, Washington. Operations should be underway this month, upon completion of a dock and a road to the ore body. The Kendrick Bay ore will be shipped by barge from Prince of Wales Island to Puget Sound and then hauled by rail and truck to Ford. Mr. Ross and Mr. Adams discovered the first commercial uranium deposit in Alaska early in the summer of 1955. Dawn is a subsidiary of *Newmont Mining Corporation*, and will concentrate ores from the Spokane Indian Reservation area as well.

QUEBEC—*Quebec Iron & Titanium Corporation* will increase its production of titanium dioxide slag by 60 percent with the installation of three new furnaces and auxiliary equipment at the Sorel processing plant. These expansion plans call for expenditure of $16,000,000. The three new furnaces will be of improved design, the first of which will be operating by the end of this year. The entire expansion is to be completed by the beginning of 1959. Also included in the plans is a second dock and tower unloader, a speeded up conveyor system for handling additional ore tonnage, and extension of the plant service facilities. The company also plans to improve existing dock facilities at Havre St. Pierre on the St. Lawrence where the ore is loaded aboard ship for transportation 555 miles upstream to Sorel. At Havre St. Pierre, the company will also install new crushing, railroad, and related equipment.

ONTARIO—A total of 106,800,000 tons of magnetite iron ore has been indicated by diamond drilling so far on the property of *El Sol Gold Mines, Ltd.*

Moving Supplies to Manitoba Nickel Site

Tractor trains like those shown above transported 30,000 tons of materials and equipment over the frozen waterways and snow of northern Manitoba to plant sites of International Nickel Company of Canada at Thompson and Moak Lake before spring break-up began last month. This was the only method of moving in these supplies, pending construction of adequate transportation facilities, and had to be completed before the thaws set in. Twenty-four trains, operating 24 hours a day, were required to push forward spring construction of these two new mines and related surface plants. The tractor route extended for 35 miles from the Canadian National Railways point at Thicket Portage to the Inco sites. The Manitoba project, which will be the largest nickel-producing operation in the world next to Inco's Sudbury operations in Ontario, is estimated to cost $175,000,000. It includes opening and developing the two mines, constructing a concentrator, smelter, refinery, and transportation facilities, as well as community installations. The properties cover an area 80 miles long and up to 10 miles wide. Production is expected to start in 1960, with operation at planned capacity by 1961. Power will be supplied by the Manitoba Hydro-Electric Board which is building a plant at Grand Rapid, 50 miles from the mining area.

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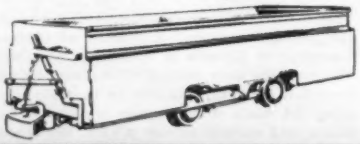

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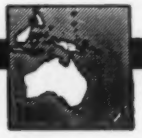
The firm holds 124 claims in the Papaonga Lake area, about 65 miles northwest of Sioux Lookout. Operations are directed by *Continental Mining Exploration Ltd.* Drilling is continuing, using five machines. Metallurgical studies are being made at the *University of Toronto, Lakefield Research Ltd.*, and the *Lurgi Laboratories* at Frankfurt, Germany.

QUEBEC—*Emerald Glacier Mines Ltd.* is conducting a geophysical survey on a newly acquired copper-gold property in Lemoine Township, Chibougamau copper mining district. The 47-claim group is located about two miles southeast of the property of *Yorcan Exploration Ltd.* on which substantial copper ore results are being obtained in diamond drilling. Diamond drilling plans of Emerald Glacier will be formulated upon completion of the geophysical survey now in progress.

BRITISH COLUMBIA—Sinking of *Granduc Mines Ltd.'s* 1,200-foot shaft has been proceeding slowly because of high pressure water encountered in the shaft which required grouting ahead of the sinking. The company is developing a copper deposit at the headwaters of the Leduc River in northwest British Columbia. Some exploratory drilling has been done, but full testing must await completion of the shaft.

MANITOBA—*Howe Sound Company* will shut down its *Snow Lake* gold mine in Manitoba because of depletion of the ore reserves. The United States firm also plans to halt operations at the copper-gold-zinc mine in Chelan, Washington because extraction costs have reached a point where operations are unprofitable. It will take between 1½ and 2 years to close these mines completely. However, the company's cobalt operations have set a new record and another plant is planned for this year. The company produced 2,435,976 pounds in 1956, compared with 1,616,260 pounds in 1955. A contract with the government calls for delivery of 6,500,000 pounds of cobalt. A pilot plant to produce cobalt by electrolysis has yielded such excellent results that a new $750,000 plant will be built and placed in operation by the end of this year. The refinery at Garfield, Utah is operating at capacity.



OCEANIA

QUEENSLAND—*Mount Isa Mines Ltd.* has been granted an authority to prospect over 1,920 square miles in central Queensland between Gladstone and Bundaberg. This is the company's first move away from the northwestern part of the state. The authority covers all minerals, but the company is particularly interested in copper. A number of small copper mines were formerly in the area granted and *Mt. Morgan Ltd.* is not far to the northwest of Gladstone. Since September of last year, Mt. Isa Mines has been granted authorities over 9,020 square miles. A large-scale prospecting program using more than 300 men is planned for the current year.

REPUBLIC OF THE PHILIPPINES—*Palawan Quicksilver Mines, Inc.* reportedly is considering expansion of its mercury furnacing plant on Palawan Island. Two 80-ton Gould furnaces are already

in operation. In February, the company treated 3,928 tons of cinnabar ore for a recovery of 20,797.19 pounds of mercury. The short month resulted in a decrease from January when recovery totaled 22,919.69 pounds.

INDONESIA—The *N.V. Perusahaan Pembangunan Pertambangan*, only share holder in the *Bank Industri Negara*, started production at the *Tjikotok-Tjirotan* gold mines in April. When working at full capacity, 220 to 240 tons of ore can be milled in 24 hours on a three-shift basis. However, initial production is about 2,300 tons per month. By July it is hoped that production can be increased to 150 tons per day. The ore will be delivered to the mill in Pasir Gombong by aerial tram. Smelting of gold-silver concentrate will be done by *Braackensiek N.V.* at Djakarta. One ton of ore is expected to yield an average of 8.9 grams gold and 440 grams silver.

NEW SOUTH WALES—*Gold Prospecting and Development N.L.* has exercised its options over beach sands deposits near Caves Beach, Swansea, where present principal operations of *National Minerals Ltd.* are based. Drilling has averaged nearly 18 percent heavy mineral.

REPUBLIC OF THE PHILIPPINES—*Atlas Consolidated Mining and Development Corporation* treated a record tonnage in its Toledo mill on Cebu Island during February and recorded its first 9,000-ton day in the last week of February. The company has already trebled its mill capacity and doubled its power supply since starting milling only two years ago. Sulphuric acid is to be produced from pyrite concentrates which are a by-product of the Atlas copper mill. The acid and fertilizer project is to be completed this June. Technical studies have been undertaken by company engineers on the smelter and refinery which may eventually be installed to process the concentrates into blister and possibly refined copper.

QUEENSLAND—*Mount Isa Mines Ltd.* is said to be about ready to begin construction of an atomic power station at a cost of £7,000,000. This would save millions in coal freight and would help to ease congestion on the Mt. Isa-Townsville railway line. The company is also said to be considering construction of a zinc processing plant. Considerable progress has been made on erection of the copper refinery at Stuart, near Townsville. The staff is being assembled; some have already returned from training in the United States, while others will shortly leave for the United States. Initial capacity of the new refinery is to be 30,000 tons annually. *Copper Refineries Pty. Ltd.* was formed to operate the plant.

REPUBLIC OF THE PHILIPPINES—A new mining corporation has been organized to explore and develop two adjoining groups of manganese claims in Buguey, Cagayan. Full-scale operation is already underway by the firm, *Northern Luzon Mining* and *Industrial, Inc.*, on the 1,772 hectares which are in barrios Pal-lagao, Argao, Buyon, and Pattao in Buguey. Engineers estimate that about 20,000 tons can be mined on the property averaging about 54.0 to 56.76 percent manganese and 0.65 iron. *Foote Mineral Company* is reported to have a standing order of 500 tons of manganese from the company.

NETHERLANDS NEW GUINEA—Rich nickel-cobalt deposits estimated to contain 75,500,000 tons have been reported on the island of Waigeo, northeast of Netherlands New Guinea. (Waigeo is separated from the mainland by the Dampier Straits.) The Netherlands government rejects the idea of government participation in prospecting companies "in view of the risks attached to mining"; however, in granting the concessions, the government will take into account the fact that it will be difficult to buld up a mining industry in New Guinea because many facilities are lacking. One of the conditions the government will impose is that the ores mined would have to be processed in Netherlands New Guinea "if this is economically possible."

REPUBLIC OF THE PHILIPPINES—*Batong-Buhay Gold Mines* has announced that it will resume operations at its properties in Lubuagan, Kalinga, in Mountain Province. The firm plans to set up a power plant and smelter at the mines.

SOUTH WEST AFRICA—*South West Africa Diamond Exploration Company (Canada) Pty. Ltd.*, in addition to locating diamonds, is also reported to have discovered tantalite and monazite deposits in its concession area. The latter is located in the southern districts of the territory, adjacent to the north bank of the Orange River.

TANGANYIKA—The indicated ore reserves in the columbium-bearing pyrochlore deposit being developed jointly by *N. V. Billiton Maatschappij* and the *Colonial Development Corporation* have been estimated at many millions of tons. The pilot plant with a capacity of 150 to 200 tons of ore per 24 hours is expected to be commissioned by August.

FEDERATION OF RHODESIA AND NYASALAND—The *Messina (Transvaal) Development Company Ltd.* has ceded its rights over its *Bukwe* iron ore deposit to the newly formed *Rhodesian Iron and Steel Company (Private) Ltd.* which also has taken over the assets of the *Southern Rhodesian Iron and Steel Commission.* The proved and probable ore reserves of the Bukwe deposits are estimated at 134,500,000 tons averaging over 60 percent Fe.

UNION OF SOUTH AFRICA—The *O'okiep Copper Company* has announced a reduction of blister copper output in the current year to about 28,000 short tons from the 1956 level of 32,785 because of a metal surplus on the world market. Any excess labor will be absorbed in the company's program of active exploration and development in the Namaqualand area.

NIGERIA—*Tin & Associated Minerals Ltd.* produced 654,920 pounds of columbium concentrate and 259,400 pounds of tin concentrate in 1956, compared with 827,942 pounds and 486,552 pounds, respectively, in 1955. Although 1955 fiscal year operations were profitable, a loss will occur for the 1956 fiscal year (ended March 31, 1957) because of the drop in the price of columbite. It had been purchased in 1955 under a United States government stockpiling program at over $4.00 per pound; termination of the pro-

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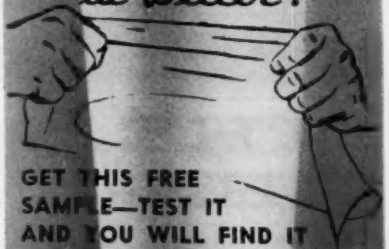

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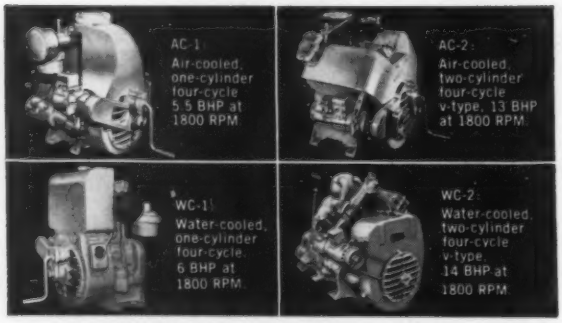

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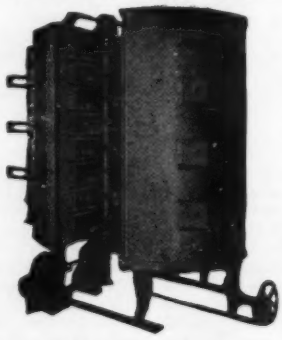

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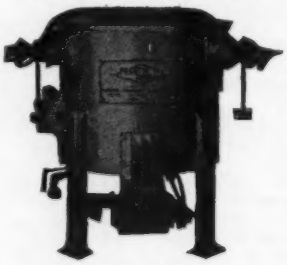

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gram has resulted in a price decrease to about $1.25 per pound. *Kennecott Copper Corporation* holds a 52 percent interest in the firm.

BASUTOLAND—The *Basutoland Diamond Corporation*, formed by Col. J. Scott of the *General Mining and Finance* group, recovered some diamonds last year though operations were concentrated on an active diamond prospecting program. Construction of a hydroelectric power plant is under consideration in the territory. Besides providing power for the area, it would provide water for internal use and also for parts of the Orange Free State, including the gold field.

BELGIAN CONGO—*Montecatini*, an Italian aluminum manufacturer, will participate technically and financially in the erection of a new aluminum plant along the lower Congo River. It will subscribe 500,000 Belgian francs of the 7,000,000 capitalization.

NIGERIA—Production of thorite in 1956 totalled 726.5 tons.

ETHIOPIA — *Goldfield Consolidated Mines Company*, *Newmont Mining Corporation*, and *Natomas Company* have closed down their prospecting and exploration operations in Ethiopia. A prospecting license had been obtained in 1955, but no "worthwhile" deposits were found, according to company spokesmen.

LIBERIA—A large United States firm, identity not disclosed, is reported to be exploring for titanium in Liberia.

SOUTH WEST AFRICA—A substantial increase is being considered in the milling capacity of *Lorelei Copper Mines Ltd.'s* facilities. Last year, the firm produced 150 tons of copper concentrates averaging 25 to 30 percent copper and 1.0 to 1.5 percent molybdenum. Plans are being considered for extending the flotation plant for the differential flotation of copper and molybdenum concentrates.

UNION OF SOUTH AFRICA—The fourth shaft of *Rustenburg Platinum Mines Ltd.* presently being sunk will be carried to a depth of about 1,500 feet. Like the other three, it is vertical. The shallowest of these three shafts is 300 feet, and the deepest 1,500 feet. The shallow sections of the mine have been opened up from incline winzes, sunk about 2,500 feet apart on strike either on the reef horizon or in the footwall, and are interconnected by reef drives. In the deeper levels, the haulage ways are in the footwall. Operations generally have so far been extended about 6,000 feet on incline from the surface, or about 1,000 feet in vertical depth.

GHANA—Better extraction rates are now being obtained from the gold recovery plant of *Ariston Gold Mines (1929) Ltd.* following adoption of a new process which makes it possible to obtain a better recovery without increasing capital expenditures or overhead. The new flowsheet reportedly means that each 1 percent improvement with the new process represents almost wholly profit. The grade went up from 5.68 dwts per ton in January to 6.18 dwts per ton in February. This, coupled with the rise in throughput from 39,140 tons to 39,690 tons, enabled the company to declare a working profit of £49,471 in February as compared with £36,902 in January.

MOROCCO—A fleet of 70 new United States-made Mack trucks has been placed in operation by a subsidiary of *Omnium Nord Africain*. The trucks haul 1,200 tons of manganese ore daily over

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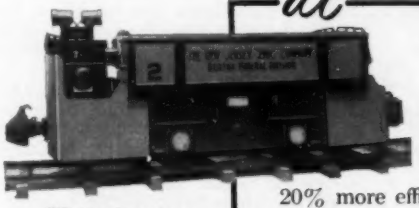

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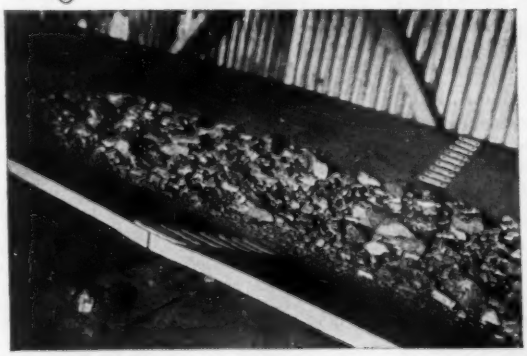

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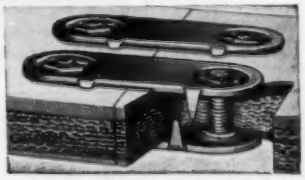

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the 12,000-foot pass of Tizin Tishka in the Great Atlas Mountains to the railhead at Marrakesh. The manganese comes from the *Imini* and *Tiouine* mines operated, respectively, by the *Societe Cherifienne d'Etudes Minieres* and the *Compagnie de Tifnout-Tiranimine*. The former produced 224,766 tons of metallurgical grade and 39,375 tons of chemical grade manganese in 1955; the latter produced 46,756 tons of metallurgical manganese in the same year. Morocco's total manganese output in 1956 rose by 3.1 percent to 383,115 tons of metallurigcal and declined by 3.7 percent to 38,294 tons of chemical grade.

FEDERATION OF RHODESIA AND NYASALAND—A chrome deposit has been discovered in the southern part of the *Belingwe Reserve*, 40 miles south of Shabani, Southern Rhodesia. This is an entirely new locality from the previous known deposits. Trenching is in progress and appearances are encouraging. A favorable feature is that the Bannockburn-Lourenco Marques Railway is only 20 miles away.

NIGERIA—Diamond prospecting may be carried on in Nigeria in the future if a special license is obtained. Until now, Nigeria has been completely closed for diamond prospecting.

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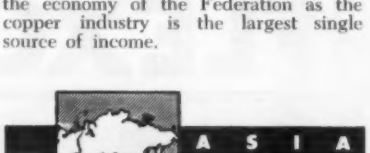
UNION OF SOUTH AFRICA—A special wind tunnel, equipped as a circular shaft, is to be constructed by the Council for Scientific and Industrial Research in Pretoria for the study of airflow through mineshafts with a view to reducing airflow losses. The tunnel will have a diameter of 6¾ feet and a length of 70 feet. In order to develop fully flow-profiles within the shortest possible distance from the inlet, boundary-layer control well be effected by means of suitably designed gauze rings. The tunnel will be equipped with a specially designed drag balance of 100-pound capacity. The tunnel will be completed this year.

GHANA—*Offin River Estates Ltd.* has decided to prospect the Offin River in selected places over a distance of 9 miles with a view to confirming diamond discoveries made there in 1954. This work is expected to take three months and, if results are satisfactory, plans for developing the area will be considered. The project is the outcome of an unsuccessful attempt to recover these diamonds by concluding royalty agreements with African contractors because a great deal of illicit diamond trading was carried on due to insufficient supervision.

FEDERATION OF RHODESIA AND NYASALAND—The recent severe recession in copper prices has already resulted in precautionary economy measures being taken by various mines, although copper prices are still well above production costs. *Nchanga Consolidated Copper Mines* (Northern Rhodesia) has postponed installation of the £2,400,000 belt conveyor system that was to transport ore from the new open pit (See MINING WORLD, March 1957, page 115). Some concern has been expressed in government circles regarding the effect that reduced taxation yields will have on the economy of the Federation as the copper industry is the largest single source of income.



JAPAN—The seven major steel companies of Japan have made an agreement with the Indian *State Trading Corporation*, a government organization, for the import of 1,300,000 tons of Indian iron ore. Saburo Tanabe of the *Fuji Iron & Steel Company* headed the mission which handled negotiations. Details of the contract are reported to be as follows: 1,300,000 dry long tons of hematite ore (10 percent allowance tolerated) will be imported from April 1957 to June 1958. Contract price of 84 s f.o.b. Tokyo per dry ton of ore of 65 percent Fe. One shilling 6 d will be added or reduced for every 1.0 percent difference in Fe content. The Trading Corporation guarantees that the amount of ore containing less than 62 percent Fe will not exceed 4.0 percent of the total importation. Delivery and loading will be completed as follows: 500,000 tons in Calcutta; 75,000 tons in Vizagapatam; 300,000 tons in Cocanada and Masulipatam; 200,000 tons in Madras; 25,000 tons in Bombay; and 200,000 tons in Kadla and Bhavnagar.

CHINA—The Peiping radio has reported that iron ore reserves estimated at 1,000,000,000 tons have been discovered on the borders of Hupeh and Szechuan Provinces in the south central part of the country.

BURMA—The Kachin State government has plans for development of the jade mines in its territory so that large-scale operations may be possible. Proper regulations similar to those used in the *Mogok* ruby mines are to be introduced to control jade development.

MALAYA—The management of the strike-bound *Raub Australian Gold Mining Company* reports it has recruited enough employees to carry on mining operations. The strike began on December 15, 1956.

TURKEY—A $3,000,000 aeromagnetic survey of all granite complexes in Turkey is planned for 1958. The money reportedly will come from the United States. Discussions are under way about contracting the job; among those being considered are *Lundberg Exploration* of Canada and *Fairchild Aerial Survey* of the United States. It will be the first big exploration campaign in the country.

IRAN—Reports from London indicate that *Union Carbide and Carbon Corporation* is negotiating with the Iranian government for mineral prospecting and development rights over an area of 330,000 square kilometers in Baluchistan in the southern part of the country. According to this information, Union Carbide would provide technical personnel and equipment for prospecting, all costs of which would be defrayed by the Iranian government. If any commercial deposits were found, development would be carried out by Union Carbide on a 50-50 basis.

JAPAN—An unidentified Japanese firm has agreed to take a full year's output from the *Macalder Nyanza* copper mine near Lake Victoria in Kenya, Africa, operated by the *Colonial Development Corporation*. The annual output from this mine is between 2,000 and 2,500 tons.

PAKISTAN—An extensive ground survey for radioactive minerals is planned; a research reactor will be installed in West Pakistan for fundamental research training of personnel, and production of radioisotopes; while a power reactor will be installed in East Pakistan. These plans have been announced by the atomic energy commission set up in March 1956. This commission also hopes eventually to establish an institute for nuclear research and reactor technology; meanwhile a nuclear laboratory will undertake the research work.

JAPAN—The *Japanese Mining Association* reports that Japanese copper smelters plan to produce a total of 155,000 tons of electrolytic copper during fiscal year 1957-1958 representing an increase of 25,000 tons over the current production goal for this fiscal year ended March 1957. Despite this increase, the Japanese Trade Ministry still intends to authorize imports of copper amounting to 24,000 tons during the year. Monthly production plans of Japanese smelters are reported as follows (in tons): *Nippon Mining Company* 3,700; *Mitsubishi Metal Mining Company* 2,800; Mitsubishi, after December 1957, 3,800; *Sumitomo Metal Mining Company* 2,000; *Mitsui Metal Smelting Company* 1,200; Mitsui, after October 1957, 1,500; *Dowa Mining Company* 1,100; Dowa, after October 1957, 1,200; *Furukawa Mining Company* 1,000; *Furukawa Denki Kogyo*

Company 400; and *Dai-Nippon Mining Company* 200.

MALAYA — *Southern Malayan Tin Dredging Ltd.* hopes to have a dredge working in the Chenderiang Valley area early in 1959 where the estimated volume of dredgeable ground is approximately 100,000,000 cubic yards with an estimated average recoverable value of 0.426 pound per cubic yard. Total of recoverable concentrates is estimated to be 19,000 tons and, with the dredge planned to be installed, estimated working life would be 32 years with an average recovery of 593 tons of tin concentrates annually. The company has five dredges working in the Tanjoung Tualang and Teja sections.

MEXICO—Engineers of the *Teziutlan Copper Company* are surveying and diamond drilling a manganese property at Autlan, state of Jalisco, adjacent to the *San Francisco* mine being developed by *Compania Minera Autlan*. Some manganese of high grade is reported to have been uncovered. *Bethlehem Steel Corporation* has substantial interest in the *Autlan* manganese mine from which 100,000 tons of ore were produced in 1956.

COSTA RICA—The *Aluminum Company of America* is said to have discovered bauxite deposits on exploration concessions obtained from the Costa Rican government, and to have established offices preparatory to further extensive exploration work. Also interested in the area are *Reynolds Metals Company* and *Kaiser Aluminum and Chemical Corporation*.

COLOMBIA—*St. Joseph Lead Company* has an 88 percent interest in a new firm called *Cia. Minera San Jose, Inc.* which has been granted a mining concession for exploration of a promising lead outcrop not far from Bogota. By the end of 1956, a crosscut had been started through the vein, and exploration will continue this year.

MEXICO—Robert A. Crespi, a well known mining executive of several Mexican fluorspar companies, has taken a lease on the *Maravillas* mercury mine located at Urite, municipality of Fresnillo, state of Zacatecas. The mine was closed down about two years ago when it ran out of ore. Recently, after some exploration work other ore bodies have been located with the grade of ore reportedly averaging 1.0 percent mercury. Mr. Crespi is also preparing the development of other mercury mines located at El Cerro Colorado, municipality of Sain Alto, state of Zacatecas. The grade of ore in this group of mines is said to average 6 kilos per tons.

BRITISH GUIANA—*African Manganese Company (Mines Management) Ltd.* plans to install three crushing and washing plants over the next three years for development of a manganese ore deposit in British Guiana, according to reports from London. The planned output is 30,000 long tons of manganese concentrates per month.

CUBA—*National Lead Company* has completed the 75 percent expansion program at the United States government-owned nickel producing plant at Nicaro. *Nickel Processing Corporation*, a subsidiary of National Lead, operates the plant for the government. Rated capacity should now reach 50,000,000 pounds of nickel annually, after trial runs are completed. During the construction period, the plant was still able to set a production record in 1956 with an output of 32,123,000 pounds of nickel as compared with 30,275,000 pounds in 1955.

PERU—*St. Joseph Lead Company* and *Santander Mining Company* of Delaware have formed *Compania Minerales Santander, Inc.* to mine certain claims in Peru formerly held by Santander. The latter retains 40 percent of the new company stock in return. St. Joe, for its 60 percent of the stock, has agreed to invest, in part as a loan, not to exceed $1,500,000 for the construction of a power plant, a 500-ton-per-day mill, and to place the property in initial operation as an open pit. Adequate reserves of copper-lead-zinc ore have been developed to justify the operation. A management contract has been signed with *Administradora de Mines S.A.*, a Peruvian firm, to supervise operations. It is expected that the property will come into production by the middle of 1958.

ARGENTINA—*Compania Minera Aguilar, S.A.*, a subsidiary of *St. Joseph Lead Company*, reported an all-time high in net income for 1956. Production of lead concentrates rose from 27,879 metric tons in 1955 to 30,334 in 1956; zinc concentrates rose from 42,204 metric tons to 42,366 metric tons. Geological exploration was carried on in various parts of the country, and the Cia Minera Aguilar staff also conducted similar work in Peru. Two copper prospects in Argentina were abandoned after extensive work had been done.

CUBA — A new mining company, *Nuevos Horizontes*, is reported to be planning to develop a lead mining claim known as *La Argentifera* in Pinar del Rio province. The firm intends to build a concentrating plant as well as furnaces with 25-ton capacity. President of the company is Carlos M. Ramirez Corria.

BOLIVIA—At a recent meeting of the managers of La Corporacion Minera de Bolivia, the status of some of the mines and possibilities for the future of these deposits was presented in chart form. The information is summarized below:

Mines	*Future possibilities*	*Approximate Mine Life (in years)*
Tin:		
Huanuni	Limited	5 to 6
Colquiri	Good	16
Potosi	Very limited	4
Quechisla		
Chorolque	Good	8
Tasna		
Siete Suyoa	Good	8
San Jose	Very limited	4
Caracoles	Very limited	5
Santa Fe	None	
Morococala		1½
Japo	None	
Viloco	Very limited	4
Colquechaca	Very limited	
Tungsten:		
Caracoles		
Petropolis		
T. del Marne	Good	5
Viloco	Good	6
Chorolque	Good	6
Tasna	Good	6
Bolsa Negra	Very limited	5
Lead:		
Quechisla	Limited	5
Silver:		
Animas	Limited	5
Lead and Silver:		
Pulacayo	Very limited	3
Copper:		
Corocoro	Good	7

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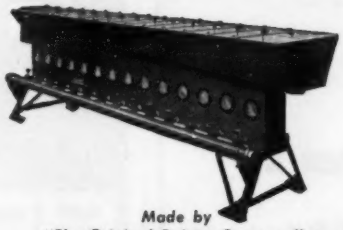

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U.S.A. Metal & Mineral Prices

METALS

		April 22, 1957
COPPER:	**Electrolytic.** Delivered F.o.b. cars, Valley basis	32.00¢
	Lake. Delivered, destinations, U.S.A.	32.00¢
	Foreign Copper. Valley basis	32.00¢
	Custom	31.00¢
LEAD:	**Common Grade.** New York	16.00¢
ZINC:	**Tri-State Concentrates,** jig, flotation 80% lead, per ton	$201.32
	Prime Western: F.o.b. E. St. Louis	13.50¢
	Prime Western; Delivered, New York	14.00¢
	Tri-State Concentrate, 60% zinc, per ton	$84.00
ALUMINUM:	**Primary 30 Pound Ingots (99% plus).** F.o.b. shipping points	27.10¢
ANTIMONY:	**Lone Star Brand.** F.o.b. Laredo, in bulk	33.50¢
BISMUTH:	(In ton lots) price per pound	$2.25
CADMIUM:	**Sticks and bars.** 1 to 5 ton lots (Price per pound)	$1.70
COBALT:	**97.99%,** keg of 550 pounds (Price per pound)	$2.00
COLUMBIUM:	**Powder** Nom., per pound	$120.00
GERMANIUM:	**Germanium:** dioxide, high purity, gram	27.50¢
LITHIUM:	**98%** (per pound)	$11.00-$14.00
	Carbonate	82.00¢
MAGNESIUM:	**Ingots (99.8%)** F.o.b. Valasco, Texas, per pound	36.00¢
MERCURY:	**Flasks.** Small lots, New York	$255.00-$257.00
NICKEL:	**"F" Ingots (5 pounds).** F.o.b. refinery, Port Calbourne, Ontario	74.00¢
SELENIUM:	**99.5%,** per pound	$13.50-$15.50
THORIUM:	per kilogram	$43.00
TIN:	**Grade A Brands.** New York (Price per pound) Prompt delivery	$1.00
TITANIUM:	**99.3%** + Grade "A" Sponge (Price per pound)	$2.75
URANIUM:	**Nominal,** per kilogram	$40.00
U-235:	**Nominal,** per kilogram	$11,000.00
GOLD:	**United States Treasury Price**	$35.00 per ounce
SILVER:	**Newly mined domestic.** United States Treasury price	90.5¢
	Foreign Handy Harmon	91.37¢
PLATINUM:	**Per Ounce**	$92.00-$95.00
ZIRCONIUM:	**Sponge, Per Pound,** Nominal	$10.00

ORES AND CONCENTRATES

BERYLLIUM ORE:	**10 to 12% BeO.** F.o.b. mine, Colorado	$46.00 per unit
	Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $50.	
CHROME ORE:	F.o.b. railroad cars eastern seaports. Long tons dry weight.	
	African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio	$56.00-$57.00
	African (Transvaal). 48% Cr_2O_3. No Ratio	$40.00-$41.00
	Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio	$60.00
	U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade ore and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.	
COLUMBIUM-TANTALUM ORE:	At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)	
	Per Pound Pentoxide.	$1.15-1.35
IRON ORE:	**Lake Superior. Per gross ton Lower Lake Ports**	
	Mesabi, Non Bessemer, 51.5% Fe.	$11.45
	Mesabi, Bessemer, 51.5% Fe.	$11.60
	Old Range Non Bessemer.	$11.70
	Old Range Bessemer.	$11.85
	Swedish, Atlantic Ports, 60 to 68% Fe. Contracts, Per Unit	28.00¢
MANGANESE ORE:	**Metallurgical grade.** 48 to 50% Mn. Long ton unit	$1.55-$1.60
	Metallurgical grade. 46 to 48% Mn. Long ton unit	$1.50-$1.55
	Metallurgical grade. 44 to 46% Mn. Long ton unit	$1.45-$1.50
	Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore. Phillipsburg, Montana; base price of $6.43 per long ton unit of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.	
MOLYBDENUM CONCENTRATE:	**90% MoS_2 F.o.b.** Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers	$1.10
TUNGSTEN CONCENTRATE:	**Domestic.** 60% WO_3 Per short ton unit	$55.00
	Foreign. 65% WO_3 Per short ton unit (Scheelite)	$27.00
	Foreign. South American, Spanish, Portuguese	$22.00
URANIUM ORE:	**Carnotite-Roscoelite.** F.o.b. purchase depot plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado. Salt Lake City, Marysvale, Thompsons, Moab, White Canyon, Green River, and Monticello, Utah. Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Riverton, Wyoming, Tuba City, and Cutter, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.	
VANADIUM ORE:	**Carnotite-Roscoelite.** V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V_2O_5 to U_3O_8 ratio and all contained V_2O_5 is paid for. Per Pound V_2O_5	$0.31

NON-METALLIC MINERALS

BENTONITE:	**Minus-200-mesh.** F.o.b. Wyoming points. Per ton in carload lots	$12.50
	Oil Well grade. Packed in 100 pound paper bags	$14.00
FLUORSPAR:	**Metallurgical grade.** 70% efective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines	$40.00
	Mexican. 70% F.o.b. border	$24.00-$24.50
	Acid Grade. 97% CaF_2, Bulk, F.o.b. Kentucky, Illinois, Colorado	$55.00
	Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.	
PERLITE:	**Crude:** F.o.b. mine per short ton	$3.00 to $5.00
	Plaster grades. Crushed and sized. F.o.b. plants	$7.00 to $9.00
SULPHUR:	Long ton, F.o.b. Hoskins Mound, Texas	$25.50
	Export	$30.50

LONDON METAL AND MINERAL PRICES

		April 22, 1957 Per Long Ton		USA Equivalent cents per pound[1]
COPPER:	**Electrolytic spot**	£239	15s 0d	29.97¢
LEAD:	**Refined 99%**	£111	0s 0d	13.87¢
ZINC:	**Virgin, 98%**	£ 98	15s 0d	12.34¢
ALUMINUM:	**Ingot, 99.5%**	£197	0s 0d	24.625¢
ANTIMONY:	**Regulus, 99.6%**	£222	10s 0d	27.81¢
TIN:	**Standard, 99.75%**	£774	0s 0d	96.75¢
TUNGSTEN:	**Long ton unit**	1605		$22.40
		With Sterling pound at $2.80		

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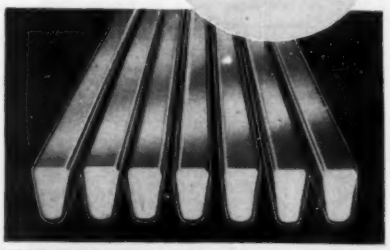

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Capitol Concentrates

Continued from page 7

in the case of import quotas or tariff duties is the same, i.e., raising the domestic price to the point where United States industry can produce at a profit.

Considering the economic position of many of the strategic minerals (where the domestic market price would have to be double, and sometimes more, in order to keep domestic mines operating) either quotas or tariffs would raise tremendous resistance in the consuming industries and the cost to the public in the last analysis would be fantastic. In cases where there is an enormous disparity between foreign and domestic prices and especially where domestic production is a fraction of imports, a subsidy plan such as that in S. 3453, 84th Congress, introduced by Senator James E. Murray and 22 other Senators, would save the taxpayers a lot of money while keeping the domestic minerals mobilization base healthy and expanding.

• Favorable Report Indicated On Phosphate Bill

The Subcommittee on Minerals, Materials and Fuels of the Senate Interior Committee has held hearings on S. 334, the bill which would double the acreage of phosphate leases which may be held in any one state without increasing the total holdings of any one company, partnership, or individual. Administration, mining association, and industry testimony was uniformly in favor of the bill with the exception of one phosphate company. This concern made a very poor showing in opposition to the bill, the testimony indicating self interest not in accordance with the public welfare. This bill passed the Senate last year, but was lost in the House, not coming up for a vote due to pressure of business during the last days of the session. It seems certain that the Senate committee will report the bill favorably.

• Cooley Would Increase Barter Funds

Representative Harold D. Cooley of North Carolina has introduced H. R. 5534 to authorize increased appropriations for bartering agricultural products for foreign minerals and other materials. As though things were not tough enough already for domestic miners!

• Senate Approves Barter Plan Extension

On April 1, 1957, the Senate approved legislation which will permit President Eisenhower to trade surplus United States agricultural products for strategic materials from Iron Curtain countries. This was no April Fool's Day joke on the domestic mining industry, as will be discovered some day. At this writing, House action had not been reported.

Interestingly enough, Senator Knowland of California strongly opposed the measure, but the conflict of interest in the partly mining, partly agricultural states, will be shown by an examination of the record of the debate. Senator Hubert Humphrey of Minnesota, for instance, who generally votes with the mining bloc of Senators, warned that he intended to hold hearings to determine why the Agriculture Department has not put more effort into obtaining strategic materials for surplus agricultural products. Yet the Senator shows a laudable interest in protecting domestic manganese production.

It may not be too long before someone tries to remove the "lock-up" clause from the supplemental stockpile, and then watch out!

COMING CONVENTIONS

May 24 and 25. Annual spring meeting, CENTRAL APPALACHIAN SECTION, AIME, Maple Shade Inn, Pulaski, Virginia.

May 28, 29, 1957. SECOND REACTIVE METALS CONFERENCE, Southern California Section of AIME, Ambassador Hotel, Los Angeles, California.

July 14, 15, and 16. The 54th Annual Convention of the IDAHO MINING ASSOCIATION, Sun Valley, Idaho.

September 8, 9, 10, and 11. Sixth Commonwealth Mining and Metallurgical Congress, Vancouver, British Columbia. Additional meetings will be held in seven other Canadian cities ending at Halifax, Nova Scotia, October 9. Field trips to many Canadian districts will form an important part of Congress.

September 9 to 12. Mining convention of the AMERICAN MINING CONGRESS, Salt Lake City, Utah.

September 18 through 21, 1957. INTERNATIONAL MINERAL DRESSING CONFERENCE, Royal Institute of Technology, Stockholm, Sweden.

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1—Sullivan model L-111
2—Joy "Turbinair" model F-113
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1—Gardner-Denver model HM

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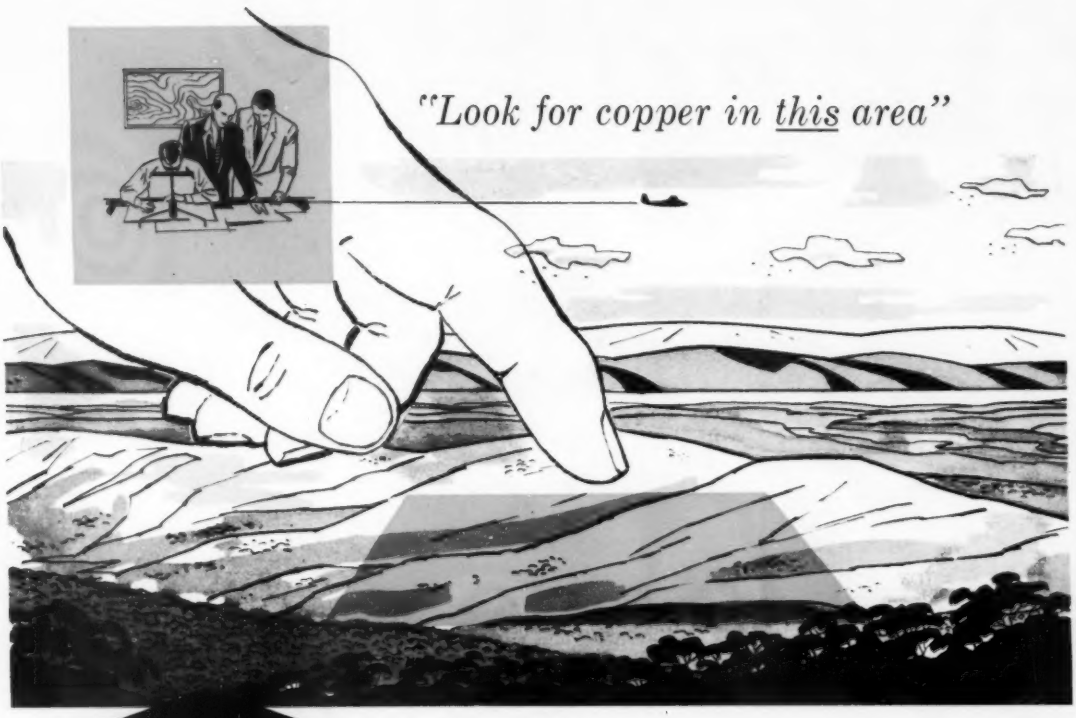

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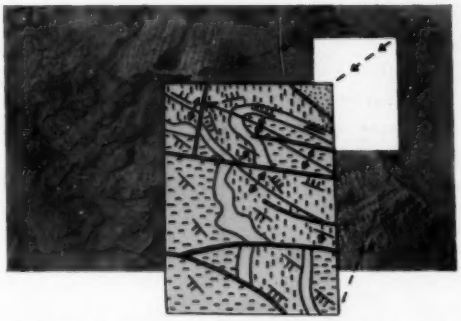

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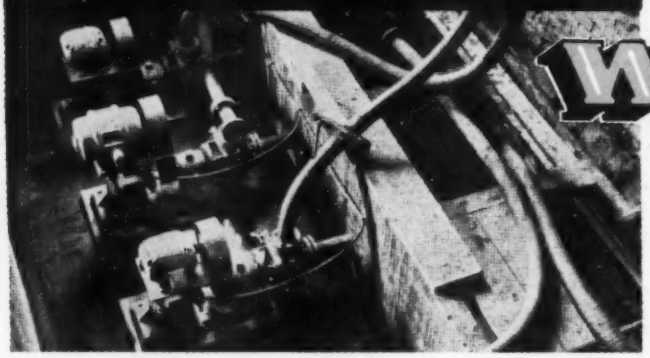

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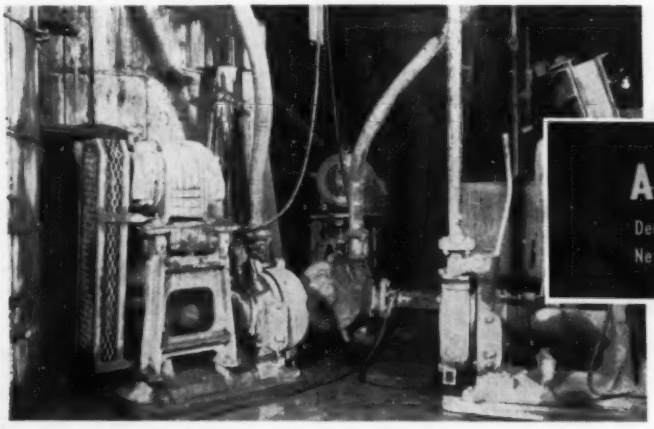

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